

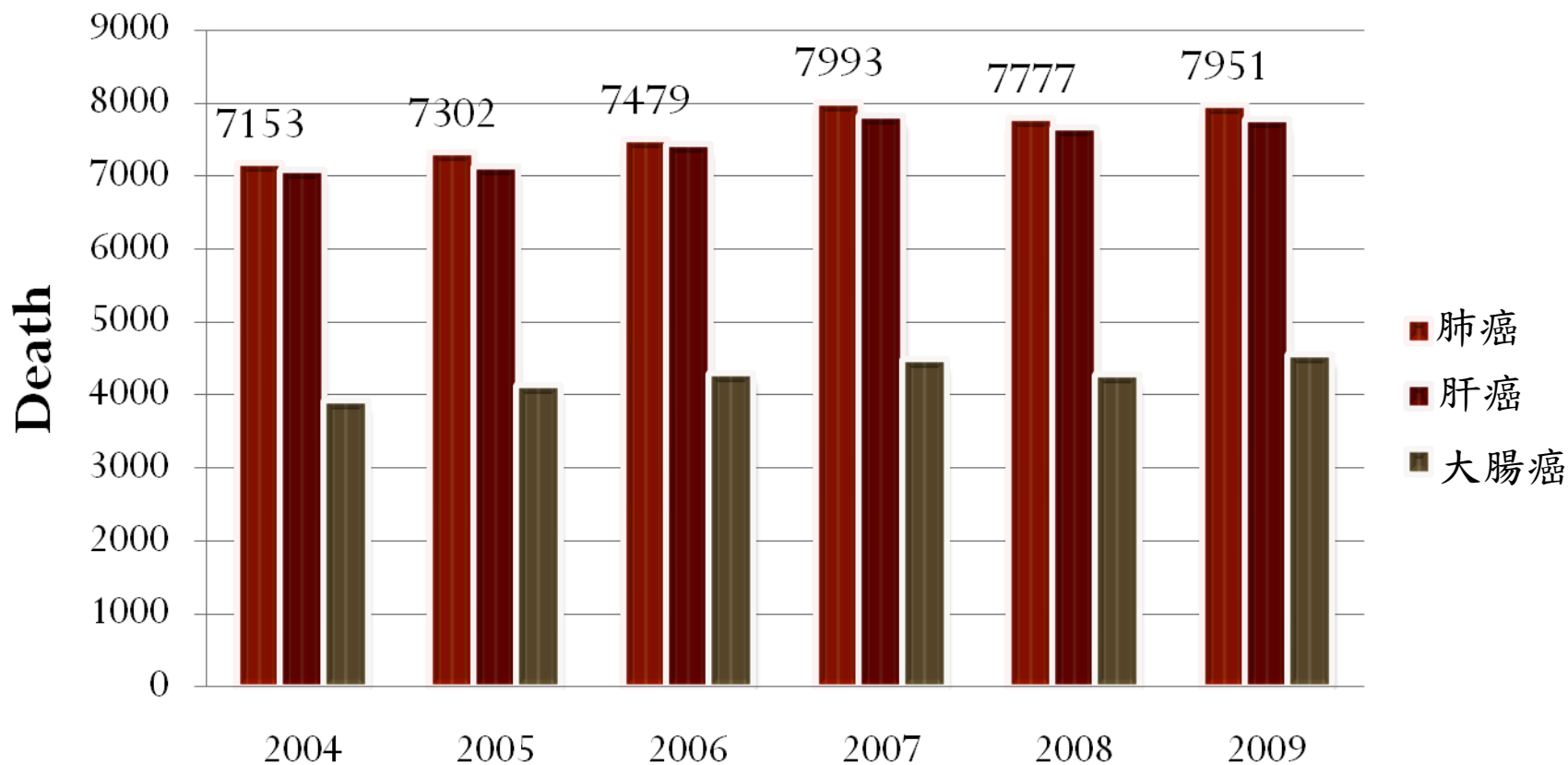
# 肺癌的手術治療

## Surgery for Lung Cancer

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# 肺癌：近年來台灣癌症死亡原因之第一名



資料來源：行政院衛生署

# 非小細胞肺癌：

約佔所有肺癌之85-90%

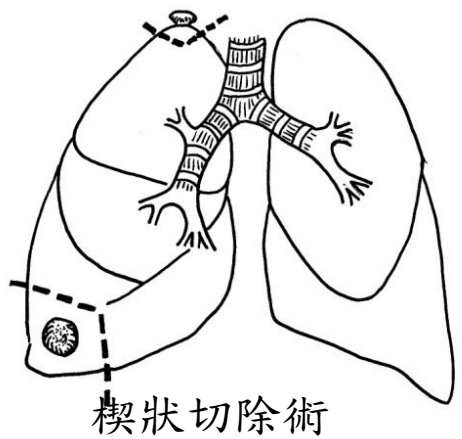
外科手術之角色：

根除性切除：提供早期肺癌病患最佳根治及存活機會

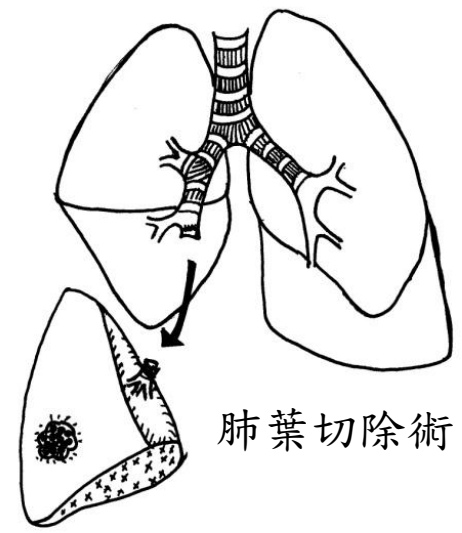
確定診斷與分期

症狀解除

# 肺癌手術簡介： 肺臟切除不再重生



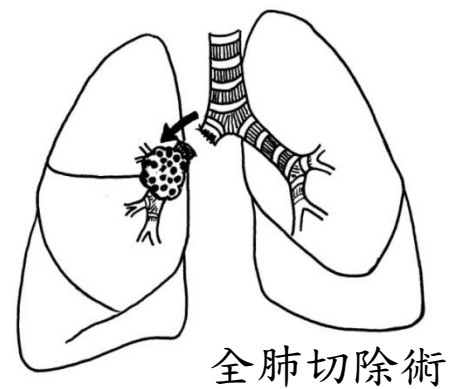
楔狀切除術



肺葉切除術



雙肺葉切除術



全肺切除術

肺癌手術後肺活量短期減少 40-70%;  
長期減少10-40%，如何減少短期傷害？

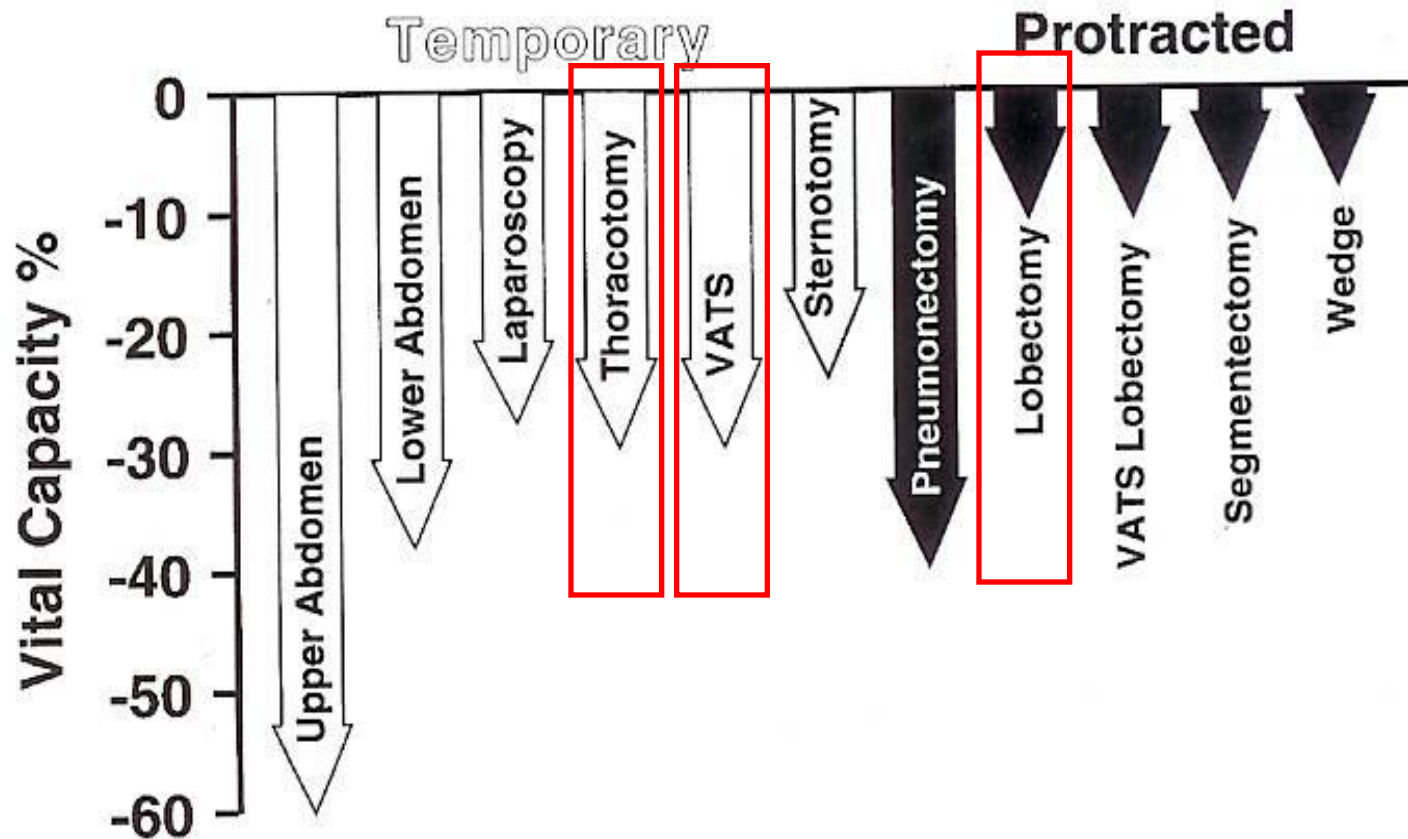


Fig. 19-1. Effect of surgical procedures on vital capacity. VATS, video-assisted thoracoscopic surgery.

# 肺癌手術及麻醉之進展趨勢：

## 肺癌手術及麻醉之風險：

老年病患居多，心肺功能不佳  
術前及術後須追加治療，惡化身體狀況  
切除肺臟及胸壁肌肉，嚴重影響肺功能  
全身麻醉及插管使用呼吸器之併發症

## 肺癌手術及麻醉進展趨勢：

減少胸壁創傷: 胸腔鏡手術  
減少肺實質切除: 肺節切除術及楔狀切除術  
減少麻醉創傷：免插氣管內管之胸腔鏡手術

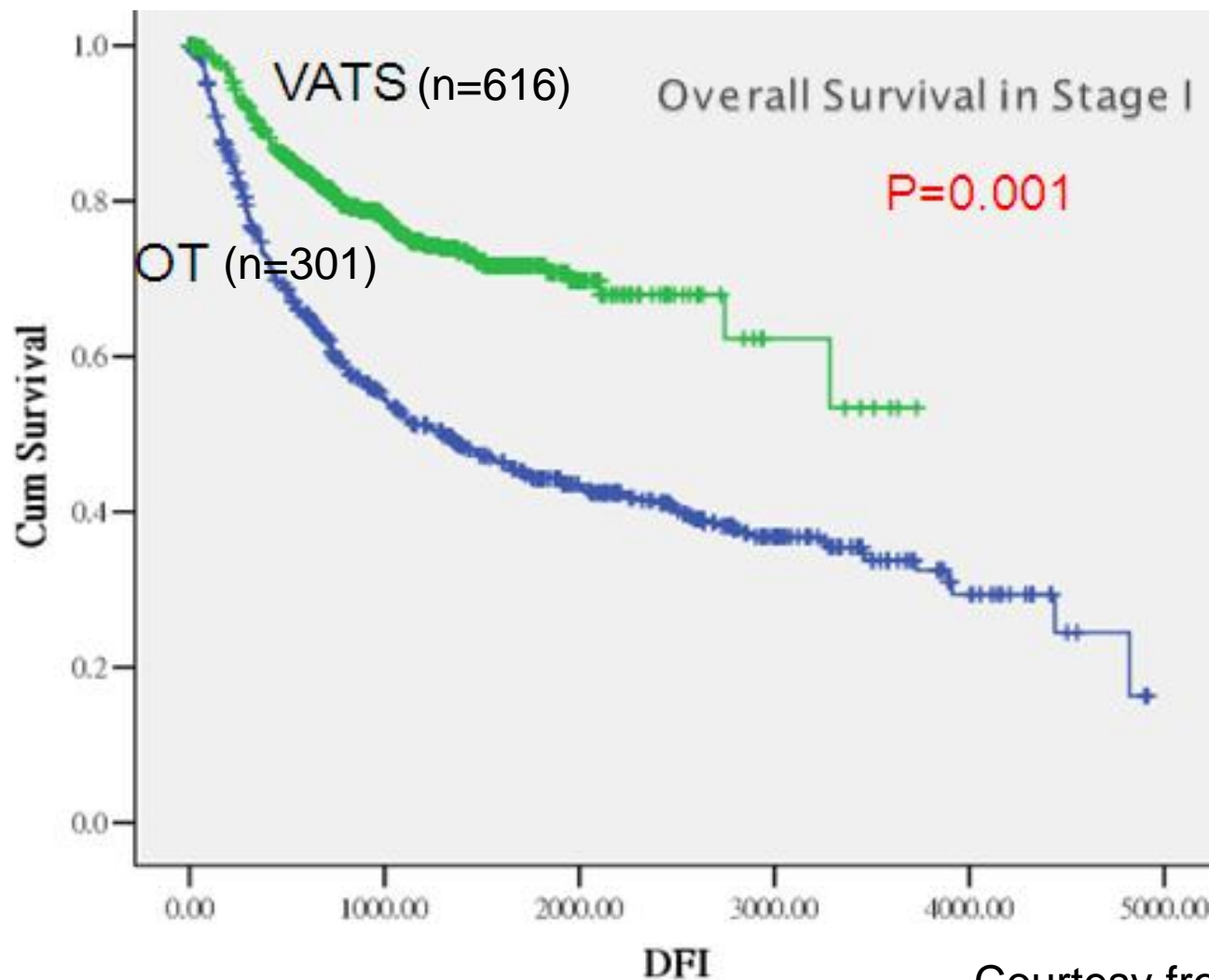
# 胸腔鏡肺葉切除術：優點

- 胸腔鏡肺葉切除術後之肺功能影響較小
- 胸腔鏡手術引發較少之發炎反應，對免疫功能較好
- 胸腔鏡肺葉切除術後長期生活品質較好

1. Kaseda S. Ann Thoracic Surg, 2000
2. Leaver HA. Eur J Clin Investi, 2000
3. Sugiura H. Surg Laparo Endo, 1999

# VATS vs. Thoracotomy?

台大醫院肺癌手術經驗 (1997-2010)



Courtesy from Dr. Kuo SW



# 肺葉切除術：胸腔鏡或開胸手術？

- 目前胸腔鏡肺葉切除術已經有許多醫學中心使用於肺癌之手術治療。
- 安全性：與開胸手術類似，甚至更好
- 腫瘤學方面考量(JCO 2009 meta-analysis)：
  - 局部復發率沒有差別
  - 遠處轉移率較低
  - 5年死亡率較低

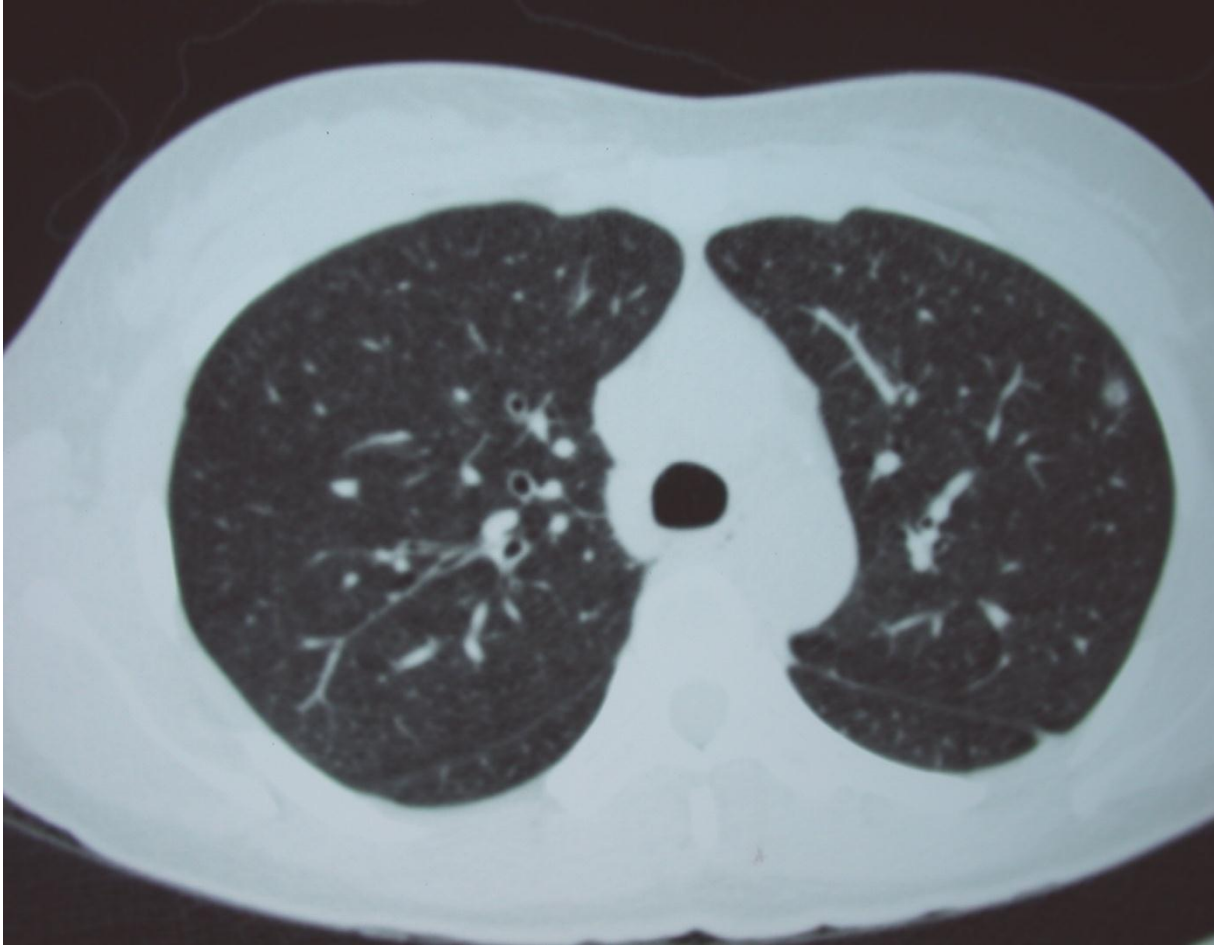
# B. 如何減少肺實質切除？

## Lobectomy or less?

**Lobectomy → Sublobar resection**

- 1. Wedge resection**
- 2. Segmentectomy**

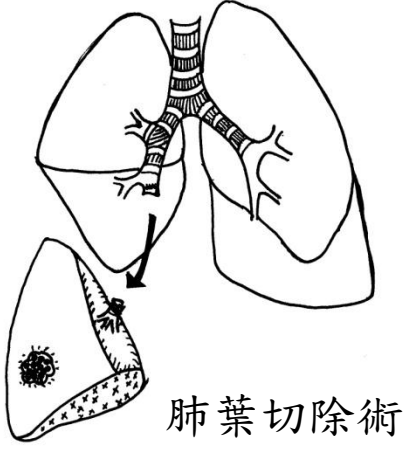
62 歲女性，胸部電腦斷層發現0.7公分結節，  
是否一定要接受肺葉切除？



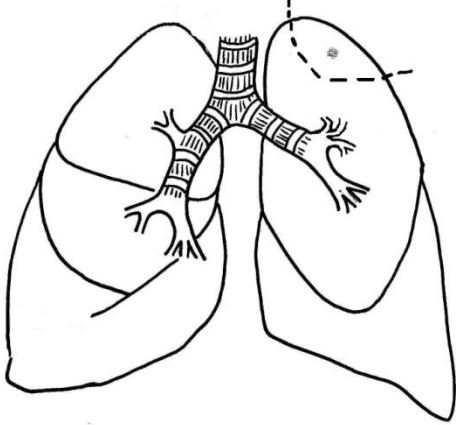
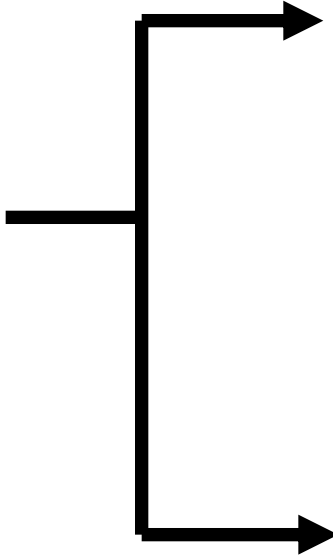
# VATS sublobar resection for lung cancer

- 包括楔狀切除(wedge resection)或肺節切除(segmentectomy)
- 局部復發率可能稍高，但長期存活率和肺葉切除術類似
- 楔狀切除或肺節切除之適應症：
  - 腫瘤小於2公分, 特別是Bronchioloalveolar cell carcinoma (BAC)
  - 之前曾接受肺臟手術
  - 年齡大或心肺功能差之病患

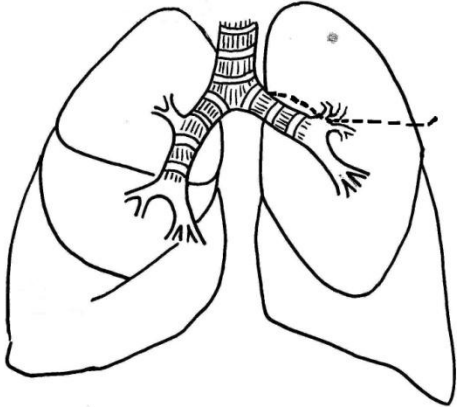
# Sublobar resection for lung cancer



**Lobectomy**



**Wedge resection**



**Segmentectomy**



術後6日出院，  
日常生活不受  
影響

Post-op CXR

# 傳統胸腔鏡手術之麻醉

## C. 如何減少麻醉創傷？

General anesthesia with muscle paralysis  
Endotracheal intubation with one lung ventilation

-> 醫師輕鬆，病患危險增加：

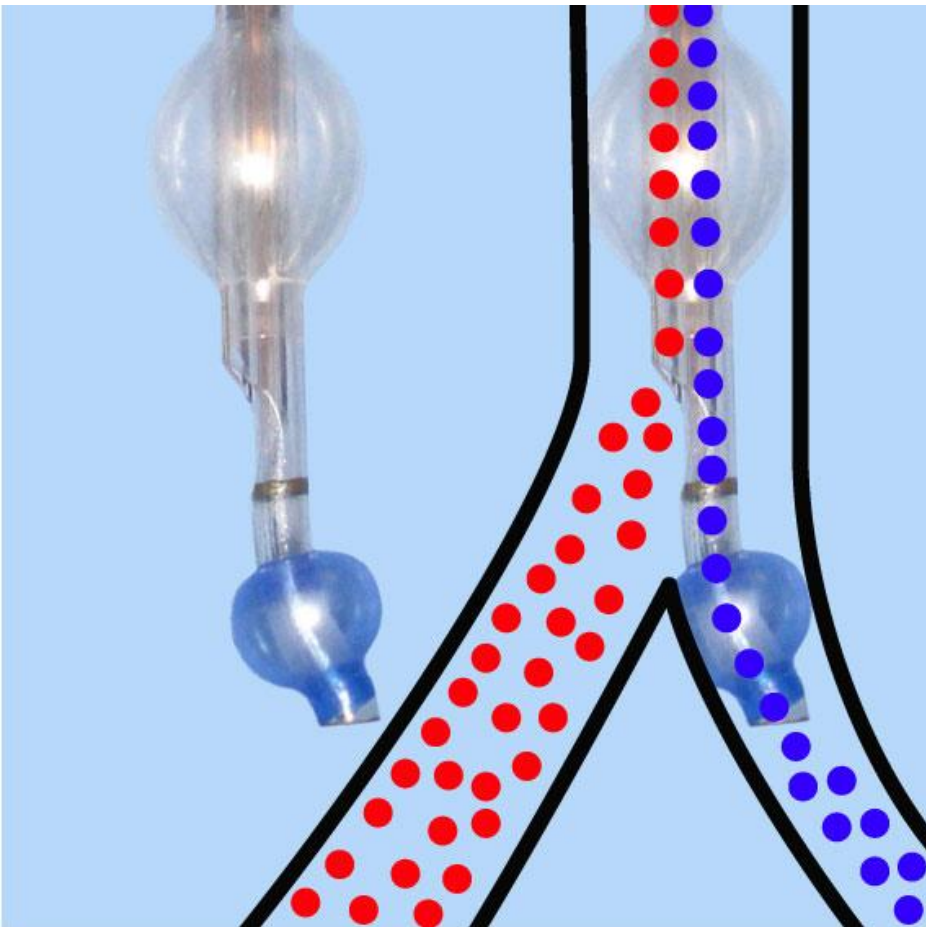
Increased risk of pneumonia

Impaired cardiac performance

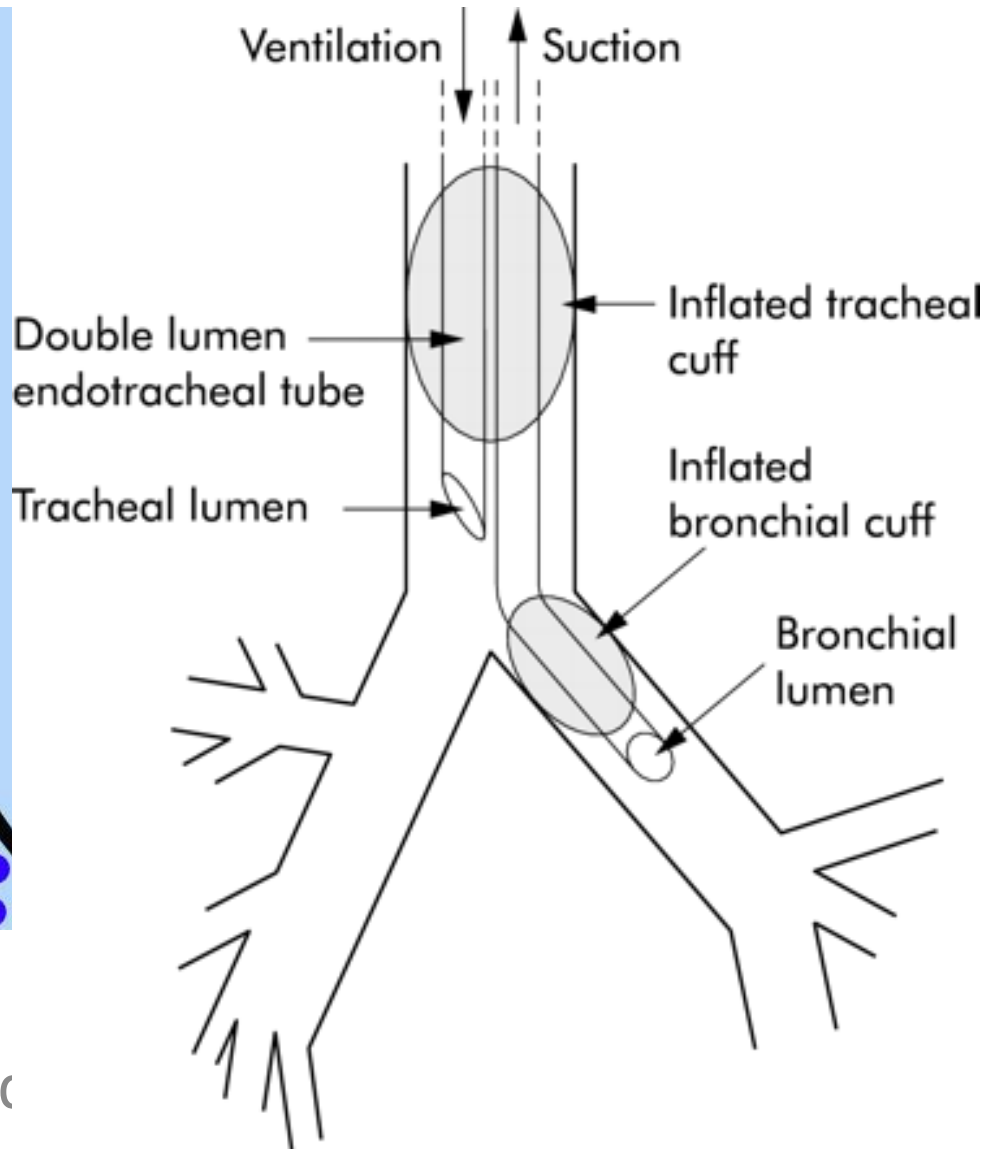
Barotrauma by ventilator

Pulmonary atelectasis

Intubation-related complication



Left-sided

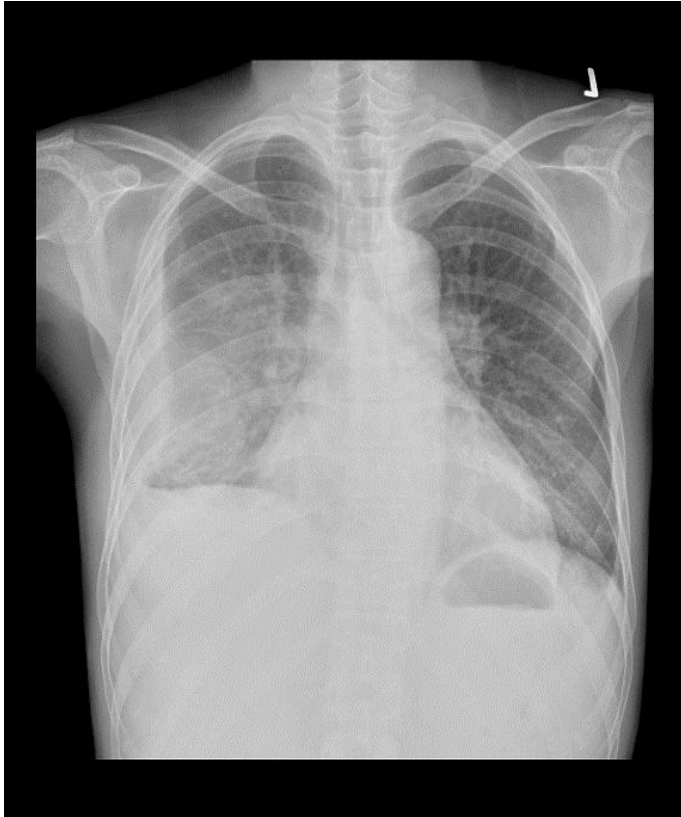




# Double lumen endotracheal tube- 長又粗，不適合東方女性



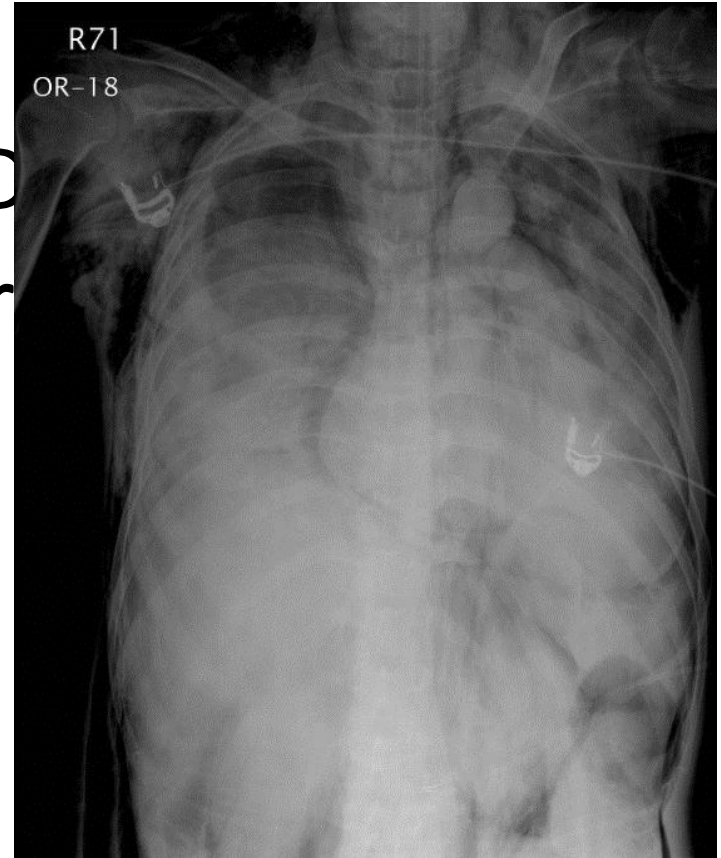
Carlens tube,  
Since 1949



Before Double-lumen intubation

Courtesy from Dr. Hsu HH

with ID  
with r



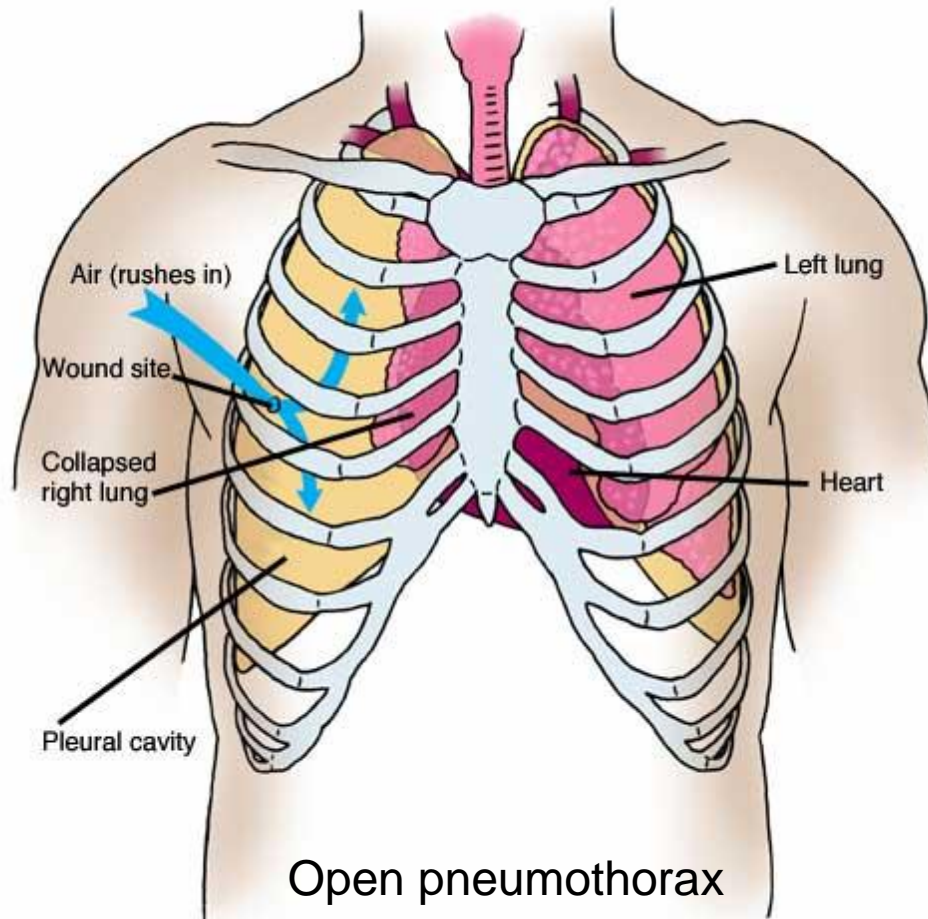
CPR for Tension pneumomediastinum after  
Double lumen intubation

# 免插氣管內管胸腔鏡手術 Non-intubated (Awake) VATS

## 免氣管插管胸腔鏡(nonintubated VATS)手術之優點

無插管之併發症  
心血管之功能較不受影響  
Improved myocardial blood flow  
Improved LV function  
Reduced heart rate and arrhythmia  
術後肺功能恢復較好  
Intact cough ability immediate after op  
Improved post-op lung function  
COPD 術後發作之比例較低  
Decreased bronchospasm  
Decreased respiratory complications

# 病患自主呼吸，如何讓手術之肺臟塌陷？



近代Nonintubated thoracic surgery 之創始：

## 针灸传奇【尼克松参观针灸麻醉开胸术】

原美国总统尼克松参观针灸麻醉开胸手术：

据著名的胸外科专家辛育龄讲“上世纪**70**年代，中美关系出现了缓和，**1972**年尼克松访华，在访问期间，他们特意提出要参观针灸麻醉，因为他觉得这实在不可思议的魔术。



# Nonintubated VATS手術現況:

肋膜腔疾病之診斷及治療：

Pleural biopsy (199?)

Spontaneous pneumothorax, empyema (1998)

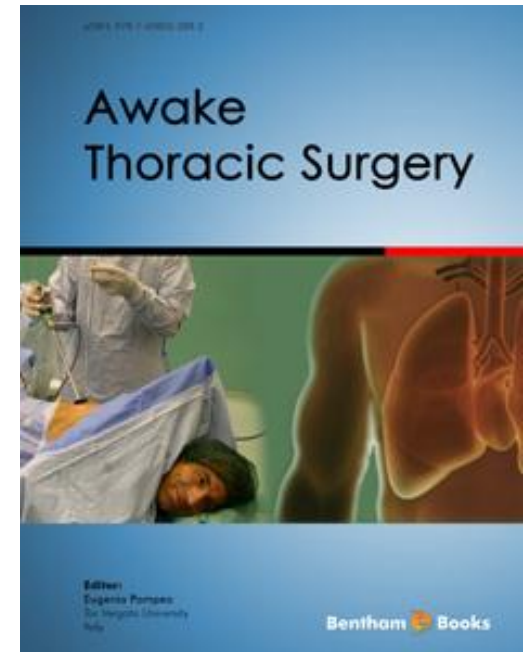
周邊楔型肺臟切除：

Resection of pulmonary nodules (2004)

Resection of solitary metastasis (2007)

Lung volume reduction surgery (2006)

肺葉切除：目前只有本團隊研究報告  
(2011)



# Nonintubated VATS需克服之困難：

肺功能不良病患，使用單肺自主呼吸可能引發  
血中二氧化碳濃度過高，甚至呼吸衰竭

手術時肺臟及縱隔腔位移

支氣管受刺激，引發咳嗽反應

側躺開刀姿勢，要再插**double lumen tube**困難

# Nonintubated VATS在台灣或台大醫院是否可行？

台灣手術室麻醉現況：

麻醉醫師只有在插管及拔管時會出現

一位麻醉科醫師須同時照顧數位病患

麻醉安全第一守則：建立安全及穩固的呼吸道  
放倒病患及氣管插管是最好的選擇

胸腔手術不插氣管內管：

自找麻煩！

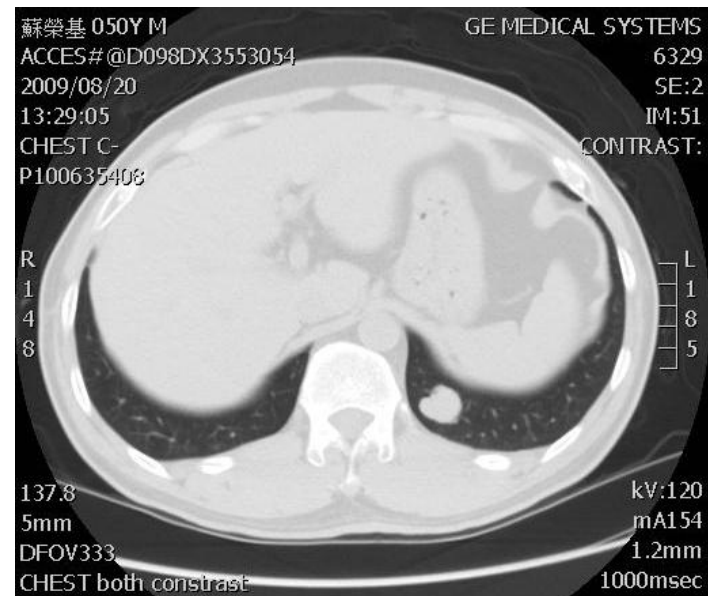
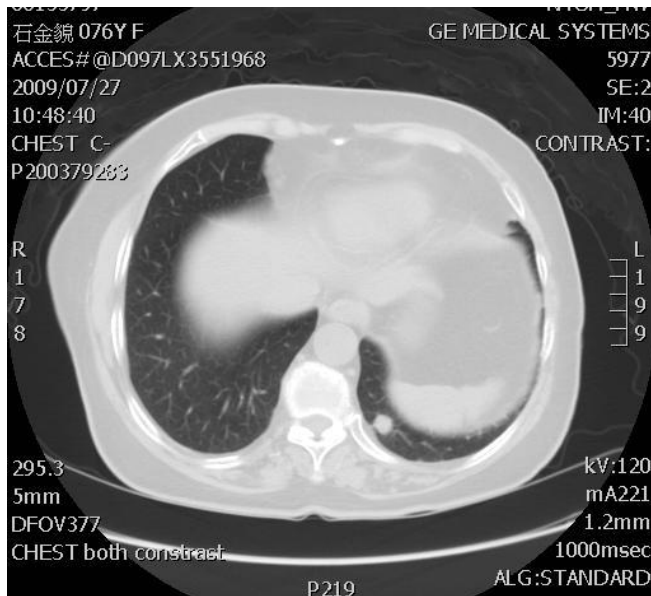
發神經了？



# 前兩例Nonintubated needlescopic VATS 切除肺節結

76歲女性，大腸癌術後  
左下肺1公分腫瘤

59歲男性，胸腺癌術後  
復發



# Nonintubated Needlescopic Video-Assisted Thoracic Surgery for Management of Peripheral Lung Nodules

Yu-Ding Tseng, MD, Ya-Jung Cheng, MD, Ming-Hui Hung, MD, Ke-Cheng Chen, MD, and Jin-Shing Chen, MD, PhD

Division of Thoracic Surgery, Department of Surgery, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei; Department of Surgery, National Taiwan University Hospital Yun-Lin Branch, Yun-Lin County; and Department of Anesthesiology and Division of Experimental Surgery, Department of Surgery, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan

*Table 2. Operative and Anesthetic Results*

Variable <sup>a</sup>	Frequency (N = 46)
↳ Anesthetic duration, min	30 (20–65) 33.3 ± 13.2
Surgical duration, min	60 (25–270) 69.2 ± 46.8
Global in-operating room duration, min	120 (62–315) 127.8 ± 49.8
Lowest SpO <sub>2</sub> during operation, %	98 (92–100) 97.8 ± 2.33
Peak ETco <sub>2</sub> during operation, mm Hg	38 (28–52) 38.4 ± 6.5
Conversion to intubation	2 (4.3)
Conversion to conventional VATS	8 (17.4)
Conversion to thoracotomy	0 (0)

<sup>a</sup> Continuous data are shown as the median (range) and mean ± standard deviation; categoric data as number (%).

ETco<sub>2</sub> = end tidal carbon dioxide; SpO<sub>2</sub> = oxyhemoglobin saturation by pulse oximetry; VATS = video-assisted thoracic surgery.

ing

# Nonintubated needlescopic VATS

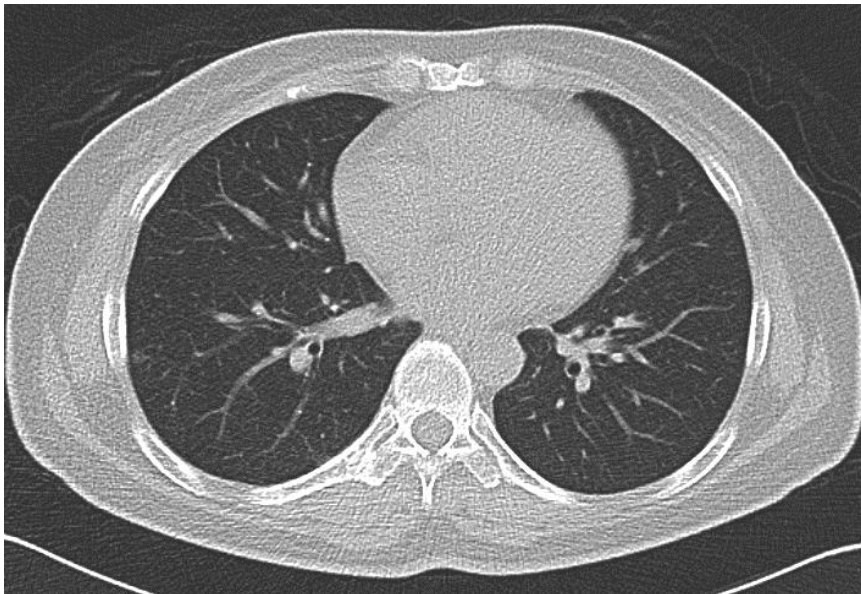
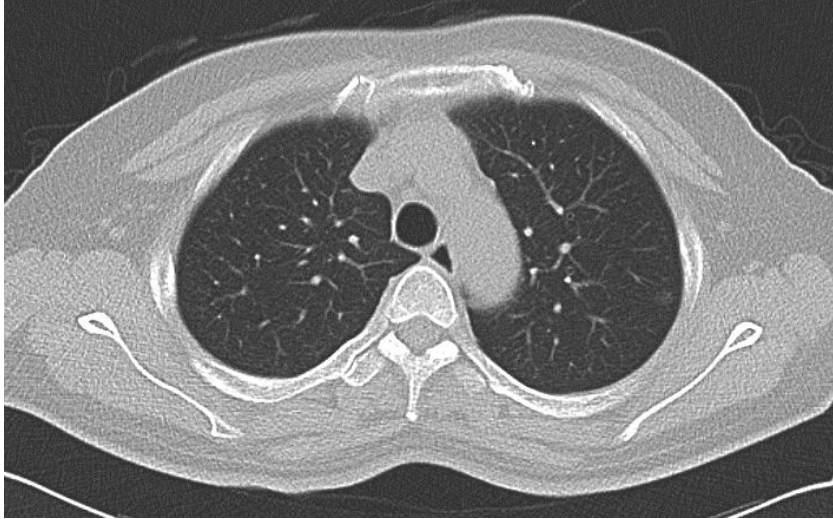
Safe and feasible

100% diagnostic rate, satisfactory scars and less wound pain

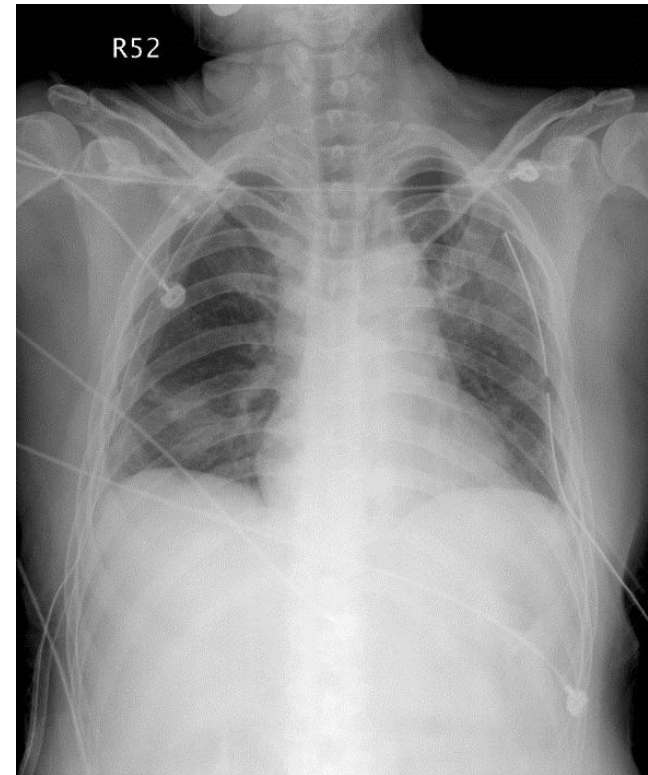
Easy conversion to standard VATS if major pulmonary resection is required

An attractive method for diagnosis of small peripheral lung nodules.

# Bilateral nonintubated VATS



58 y/o female, Sjogren's syndrome

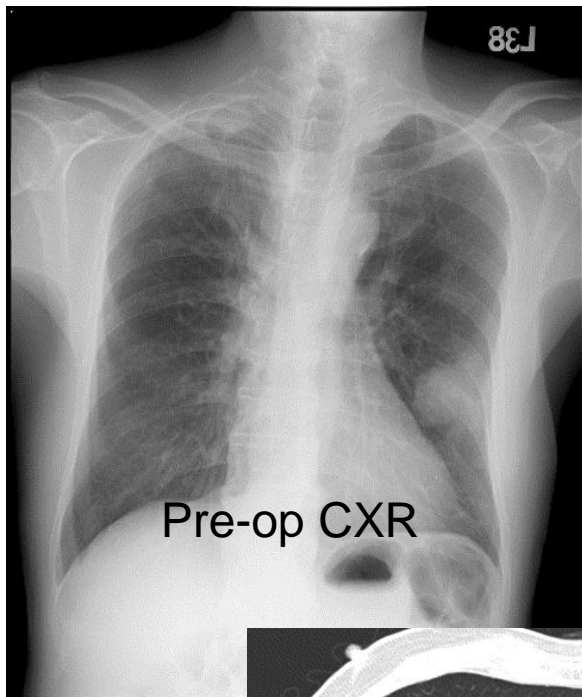


Final pathology:

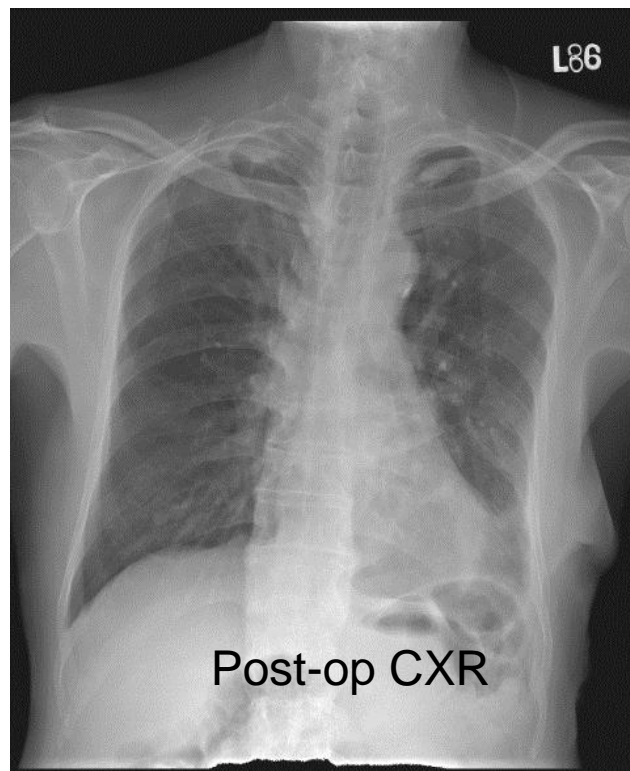
1. Left: BAC
2. Right: benign nodule

Tsai TM, et al. J Thorac Cardiovasc Surg, revision

# Non-intubated VATS segmentectomy for high risk patients:

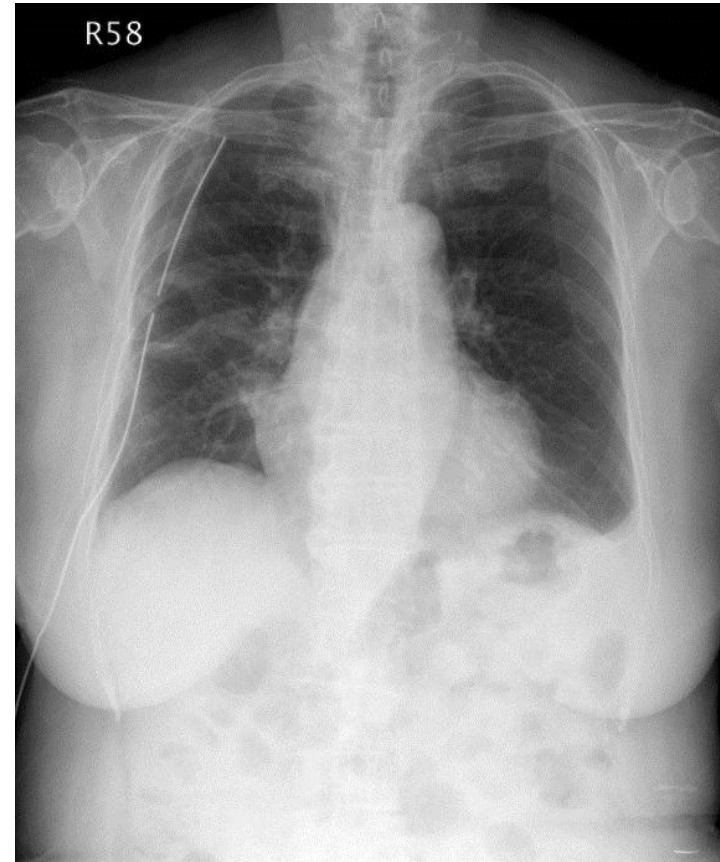


81 y/o male, COPD, LLL sq. ca  
FEV1.0: 1.02L, 44.6%  
% FEV1.0: 47.9%



Final pathology: T2aN0M0  
Postoperative stay: 4 days

81 y/o female, RLL adenocarcinoma  
FEV1.0: 0.77L, 74.5%; %FEV1.0: 58.8%



Non-intubated VATS wedge resection  
Post-op stay: 5 days

# Non-intubated thoracoscopic lobectomy: The NTUH experience



# Nonintubated Thoracoscopic Lobectomy for Lung Cancer

*Jin-Shing Chen, MD, PhD,\*† Ya-Jung Cheng, MD,‡ Ming-Hui Hung, MD,‡ Yu-Ding Tseng, MD,†  
Ke-Cheng Chen, MD,† and Yung-Chie Lee, MD, PhD\**

**Objective:** To evaluate the feasibility and safety of thoracoscopic lobectomy without endotracheal intubation.

**Summary Background Data:** General anesthesia with single-lung ventilation is considered mandatory for thoracoscopic lobectomy for non-small cell lung cancer (NSCLC). Nonintubated thoracoscopic lobectomy has not been reported previously.

**Methods:** From August 2009 through June 2010, some 30 consecutive patients with clinical stage I or II NSCLC were treated by nonintubated thoracoscopic lobectomy using epidural anesthesia, intrathoracic vagal blockade, and sedation. To evaluate the feasibility and safety of this novel technique, they were compared with a control group consisting of 30 consecutive patients with clinical stage I or II NSCLC who underwent thoracoscopic lobectomy using intubated general anesthesia from August 2008 through July 2009.

**Results:** Collapse of the operative lung and inhibition of coughing were satisfactory in the nonintubated patients, induced by spontaneous breathing, and vagal blockade. Three patients in the nonintubated group required conversion to intubated-single lung ventilation because of persistent hypoxemia, poor epidural anesthesia pain control, and bleeding. One patient in each group was converted to thoracotomy because of bleeding. The 2 groups had comparable anesthesia durations, surgical durations, blood loss, and numbers of dissected lymph nodes. Patients who underwent nonintubated surgery had lower rates of sore throat (6.7% vs 40.0%,  $P = 0.002$ ) and earlier resumption of oral intake (mean, 4.7 hours vs 18.8 hours,  $P < 0.001$ ). Patients undergoing nonintubated surgery also had a trend toward better noncomplication rates (90% vs 66.7%,  $P = 0.057$ ) and shorter postoperative hospital stays (mean, 5.9 days vs 7.1 days,  $P = 0.078$ ).

**Conclusions:** Nonintubated thoracoscopic lobectomy is technically feasible and is as safe as lobectomy performed with intubation in highly selected patients. It can be a valid alternative of single-lung-ventilated thoracoscopic surgery in managing early-stage NSCLC.

(*Ann Surg* 2011;00:1–6)

for managing early-stage NSCLC. In addition, it is supported by evidence-based treatment guidelines.<sup>1–5</sup>

Since the introduction of the double-lumen endotracheal tube, intubated general anesthesia with one-lung ventilation has been considered mandatory in both open and thoracoscopic surgery.<sup>6</sup> However, adverse effects of intubated general anesthesia occur after the operation and they include intubation-related complications, ventilator-induced lung injury, impaired cardiac performance, and postoperative nausea and vomiting.<sup>7–10</sup> To reduce the adverse effects of intubated general anesthesia, thoracoscopic surgery without endotracheal intubation has been recently employed for management of pneumothorax,<sup>11–13</sup> resection of pulmonary nodules,<sup>14</sup> resection of solitary metastases,<sup>15</sup> and performing lung volume reduction surgery.<sup>16</sup> The results achieved for these early surgeries are encouraging.

Although the feasibility of thoracoscopic surgery via nonintubated anesthesia was demonstrated in pleural and peripheral lung diseases, thoracoscopic major pulmonary resection such as lobectomy has rarely been performed via nonintubated anesthesia because of several concerns, including hypoxemia and hypercapnia induced by prolonged spontaneous one-lung breathing, uninhibited coughing induced by manipulation of the bronchial trees, and lung movement during surgical dissection.<sup>7</sup> These difficulties interfere with division of hilar vessels and bronchus during thoracoscopic lobectomy and cause dangerous complications, which may result in emergency conversion to tracheal intubation and thoracotomy.

Using combination of epidural anesthesia, intrathoracic vagal blockade, and appropriate sedation, we found that nonintubated thoracoscopic lobectomy is technically feasible although the safety and efficacy were unclear. In addition, comparison between nonintubated and intubated thoracoscopic lobectomy has never been performed. We hypothesized that nonintubated thoracoscopic lobectomy was associated with a prompt recovery of gastrointestinal function, fewer

# Patients and methods

Study design: Retrospective chart review with historical control

Study group (2009/8-2010/6):

30 lung cancer patients underwent non-intubated thoracoscopic lobectomy

Control group (2008/8-2009/7):

30 lung cancer patients with the same selection criteria underwent intubated thoracoscopic lobectomy using single-lung ventilation

# Selection criteria for thoracoscopic lobectomy

## Inclusion criteria:

Stage I or II peripheral NSCLC

Tumor size < 6 cm

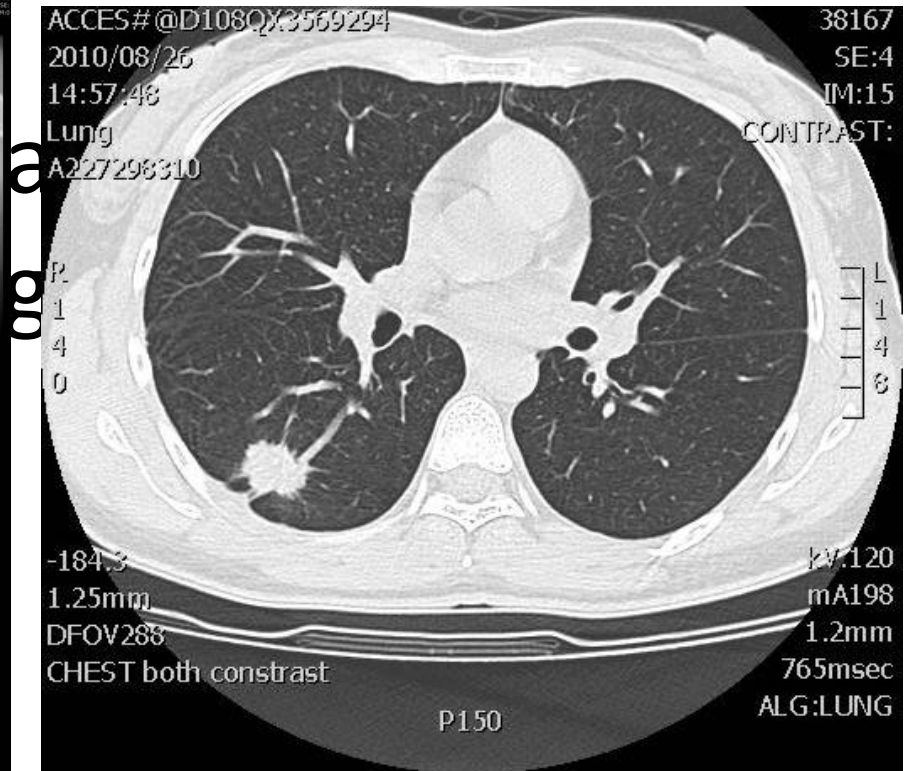
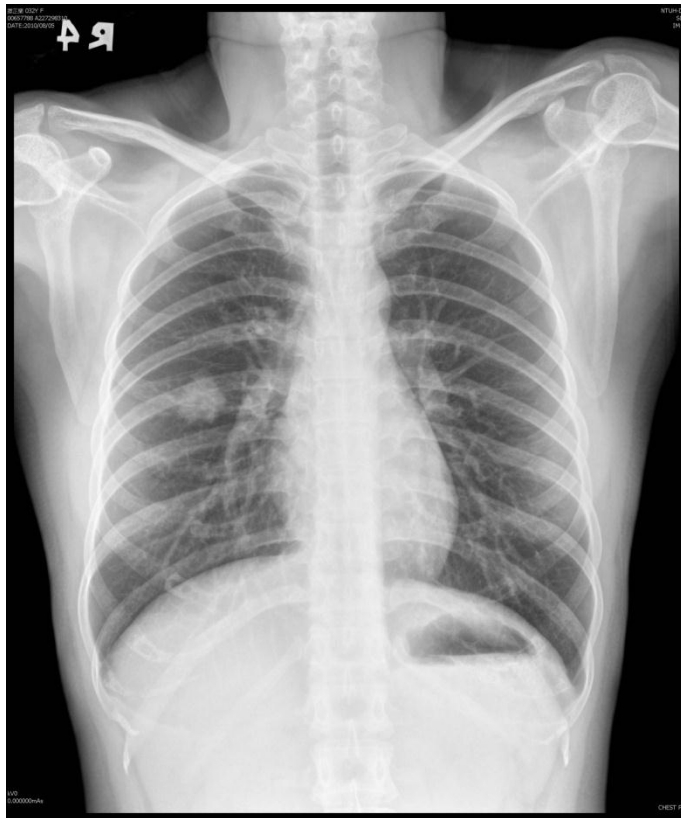
Without evidence of chest wall, diaphragm or main bronchus involvement

## Exclusion criteria:

ASA score > 3

Bleeding disorders

Unfavorable airway or spinal anatomy



# Table 5. Difference in Anesthesia methods Between Published data

Study group	NTUH, <sup>2011</sup>	Pompeo 2004, 2008, 2010	Rocco 2010**	Katlic 2010	Elia 2005
Anesthesia	Epidural IV sedation + Vagal block	Epidural + IV sedation	Epidural + Local IV sedation	Local + IV sedation	Intercostal block
Pleural	+	+	+*	+	+*
Bullectomy or bulloplasty	+	+	-	-	-
Wedge resection	+	+	+	+	-
Mediastinal manipulation	+	±	-	±	-
Lobectomy	+	-	-	-	-

\*Theoretically feasible

\*\*Confined to case report

# Nonintubated VATS: 台大經驗 (2009-2012)

A total of 258 patients underwent 259 VATS

Needlescopic VATS wedge resection: 47 cases

Conventional VATS wedge resection: 100 cases

VATS segmentectomy: 8 cases

VATS lobectomy: 104 cases (including benign and malignant diseases)

Conversion to intubated general anesthesia: 14 cases (6%)

No mortality

# 並非沒有風險

## Conversion to general anesthesia

### Timing:

Severe and dense adhesions

Poor oxygenation

Significant mediastinal movement

Uncontrollable bleeding (Emergent)

### Method:

Seal the wound with a chest tube to re-expand the lung

Rotate the operation table

Single lumen endo-tube insertion +/- bronchoscopy, followed by blocker.

## Take home message for non-intubated VATS:

1. Cooperation between surgeons and anesthesiologists
2. Risk/benefit analysis before the operation

	<b>Intubated Lobectomy</b>	<b>Nonintubated Lobectomy</b>
Benefits	A secured airway  Quiet operation field	Avoid use of ventilator and muscle relaxants Selective intubation and one-lung ventilation is not required Earlier oral intake and ambulation
Risks	Intubation-related complications Ventilator-associated complications	Conversion to endotracheal intubation: Nonemergent  Emergent Increased difficulty in operation



# 免氣管插管之胸腔鏡手術結論

可使用於診斷及治療良性及惡性肺疾病  
可進行楔狀切除術、肺節切除術、肺葉切除術  
可雙側手術

免氣管插管之胸腔鏡肺葉切除術手術成果類似  
插管麻醉之肺葉切除術

安全性

腫瘤考量

需與麻醉醫師充分溝通配合

# 肺癌手術的未來：

未來的世界是老年人的世界

體力不好、心臟不好、呼吸功能不好、手術併發症比例高

不僅開刀方式要微創，麻醉方式也要微創

縮小傷口：Needlescopic VATS

減少切除範圍：Lobectomy to segmentectomy

微創麻醉：Non-intubated VATS

General anesthesia with endotracheal intubation決不是每一台胸腔手術的必然選擇