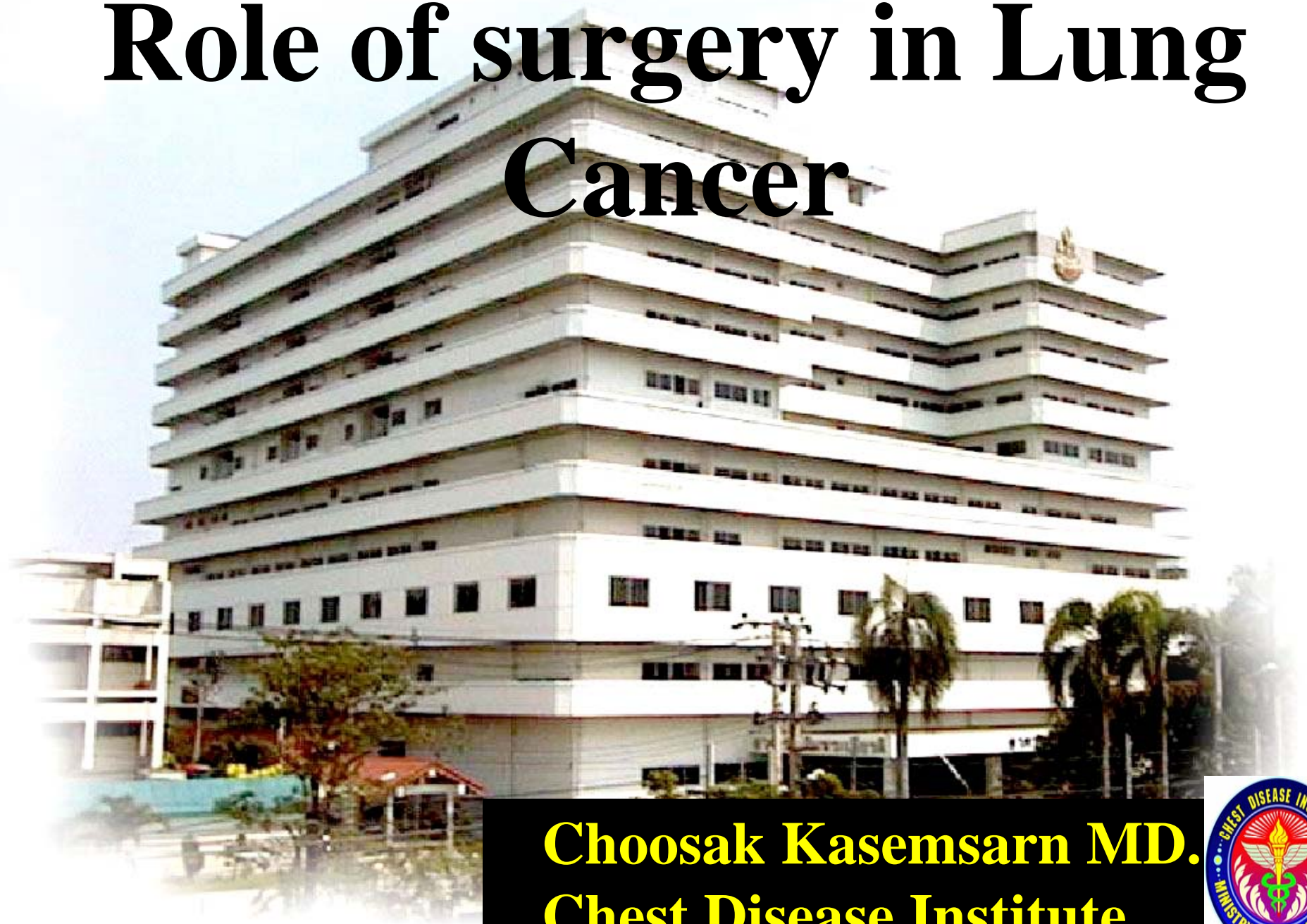


Role of surgery in Lung Cancer



Choosak Kasemsarn MD.
Chest Disease Institute



Role of surgery in Lung Cancer

- Investigation for staging
- Early stage Non-small Cell Lung Cancer (NSCLC I – II)
- Stage III A Non-small Cell Lung Cancer (NSCLC IIIA)
- Advance stage (IIIB-IV) Non-small Cell Lung Cancer
- Small Cell Lung Cancer (SCLC)



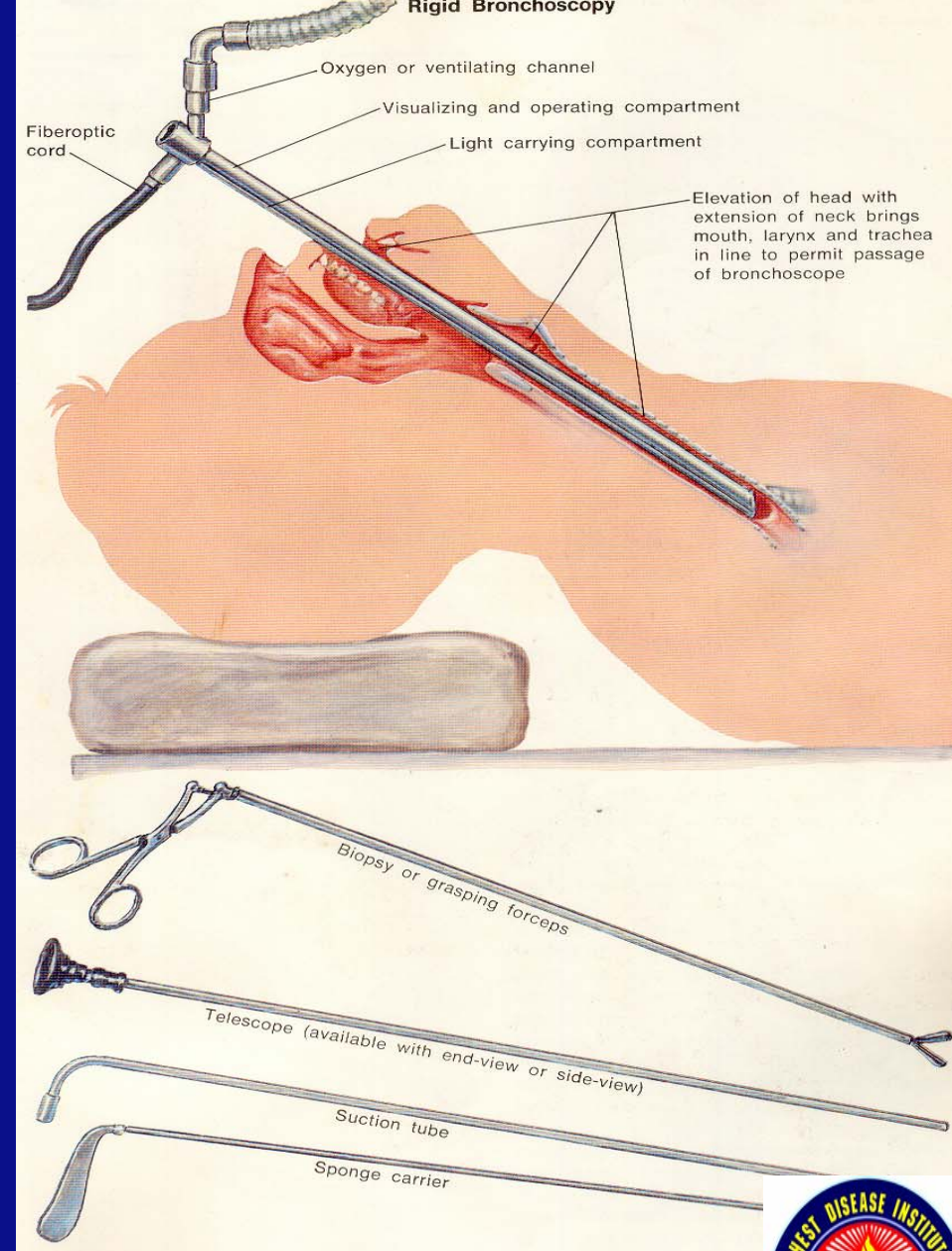
Investigation for staging

- Mediastinoscopy
- Anterior Mediastinotomy (Chamberlain procedure)
- Esophageal endoscopic ultrasound (EUS-NA)
- Transbronchial needle aspiration (TBNA)
- Transthoracic needle aspiration (TTNA)
- Endobronchial ultrasound (EBUS-NA)
- VATS staging



Mediastinoscopy

- Low mortality and morbidity
- 80 % sensitivity
- Node except posterior subcarinal, Inferior mediastinal, aortopulmonary window, anterior mediastinal nodes.
- 60% enlarged node from CT negative pathological confirm while 15-24 % small nodes positive outcome
- Instead by PET ?? False positive 15-20 %: false negative 13-25%

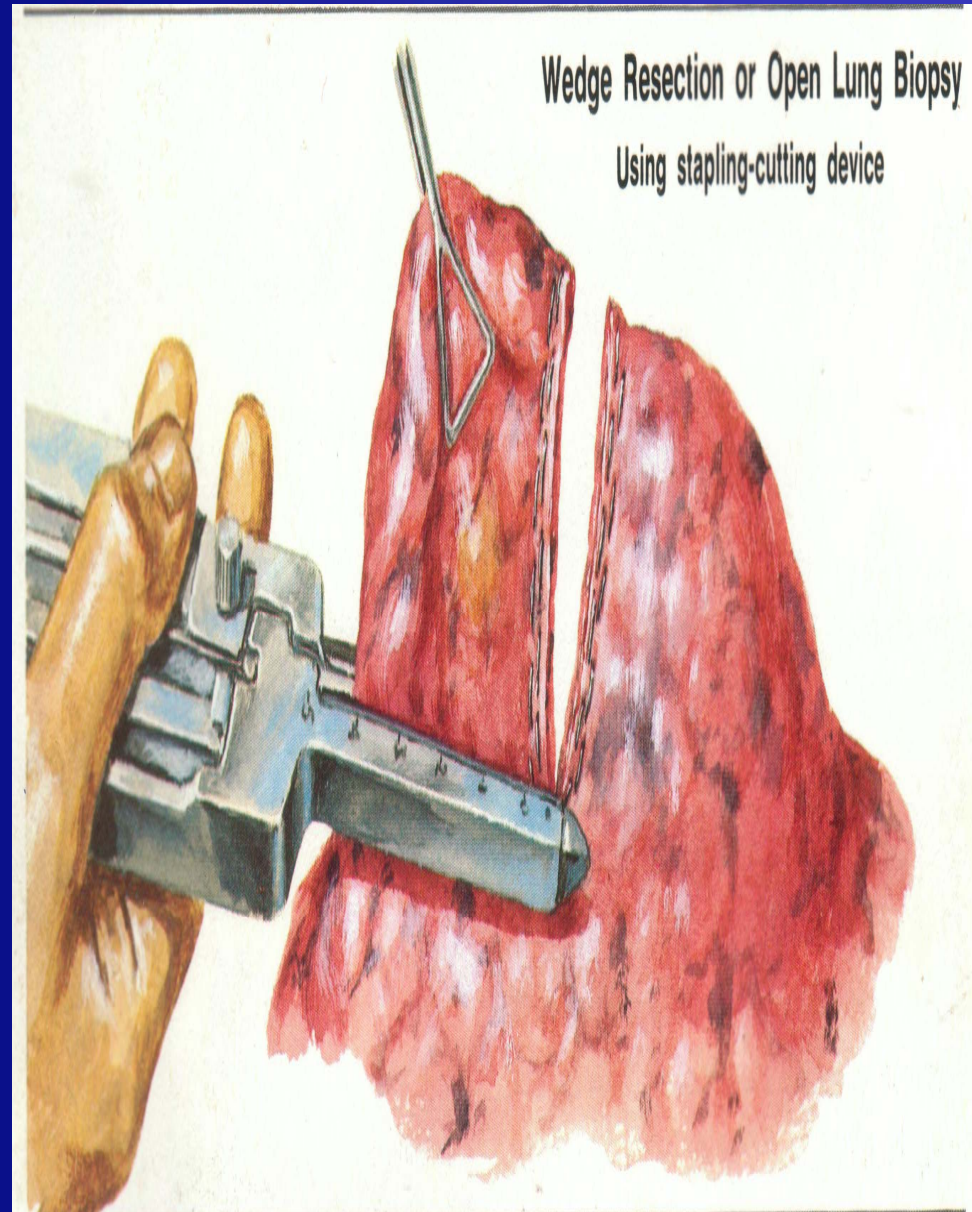
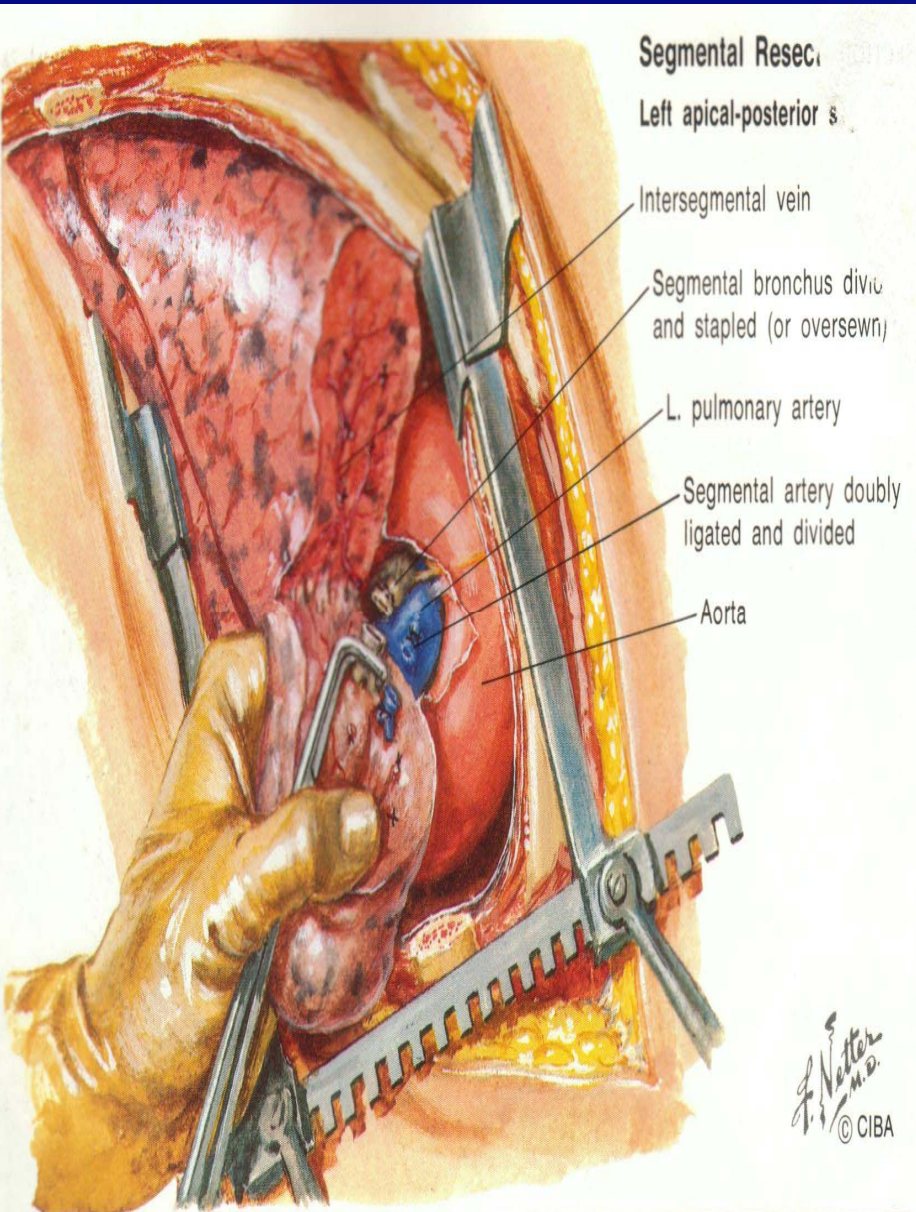


Early stage Non-small Cell Lung Cancer (NSCLC I – II)

- Surgery remains the recommended treatment approach for patients with stage I-II NSCLC
- Recent controversy about adjuvant chemotherapy for completely resected stage IB NSCLC
- Limited resection (Wedge resection – Segmentectomy)
- Subcentimeter pulmonary nodule
- VATS (Video-assisted thoracic surgery) Resection



Limited resection (Wedge resection – Segmentectomy)



Limited resection (Wedge resection – Segmentectomy)

- Threefold increase in local recurrence
- 50% increase in death with cancer rate
- Lower mortality 1.4% while Lobectomy 2.9% ; Pneumonectomy 6.2%
- Better reserved pulmonary function
- Indication in poor pulmonary function
- Subcentimeter pulmonary nodule???
- Intraoperative adjuvant brachytherapy I¹²⁵ found reduced local recurrent rate (6.1%) : American College of Surgeons Oncology Group phase III clinical trial (ACOSOG Z4032)



Favorable criteria for Intentional Sublobar Resection of NSCLC

- **Peripheral location (outer third)**
- **2 cm or less in diameter**
- **>1 cm margin on frozen section**
- **Absence of endobronchial tumor**
- **Age 75 years or more**
- **No Mediastinal and Hilar lymphadenopathy**
- **Ground glass opacity from CT**
- **Bronchoalveolar histology**



VATS (Video-assisted thoracic surgery) Resection

- Data from exploratory series have found VATS Lobectomy is safe and similar complication rate to open resection



Inclusion criteria

- Physiologic operability for lobectomy
- Clinical stage I-II lung cancer amenable to complete resection by lobectomy
- Tumor size < 5 Cm
- Benign disease (Giant bullae, Bronchiectasis, ect)



Contraindication

Absolute

- Inability to tolerate single-lung ventilation
- Intubated patient
 - high concentratrd O₂
 - high airway pressure
 - high PEEP
- Inability to achieve complete resection with lobectomy
- Chest wall / mediastinal invasion(T3 , T4)
- N2 , N3 node disease
- Central hilar lesion
- Endobronchial tumor seen at bronchoscopy or lung atelectasis



Contraindication (Continue)

Relative

- Previous thoracotomy or VATS
- Incompletely or absent fissure
- Hilar lymphadenopathy
- Neoadjuvant chemotherapy
- Prior irradiation to hilum
- Calcific bronchi
- Lesion crossing a fissure



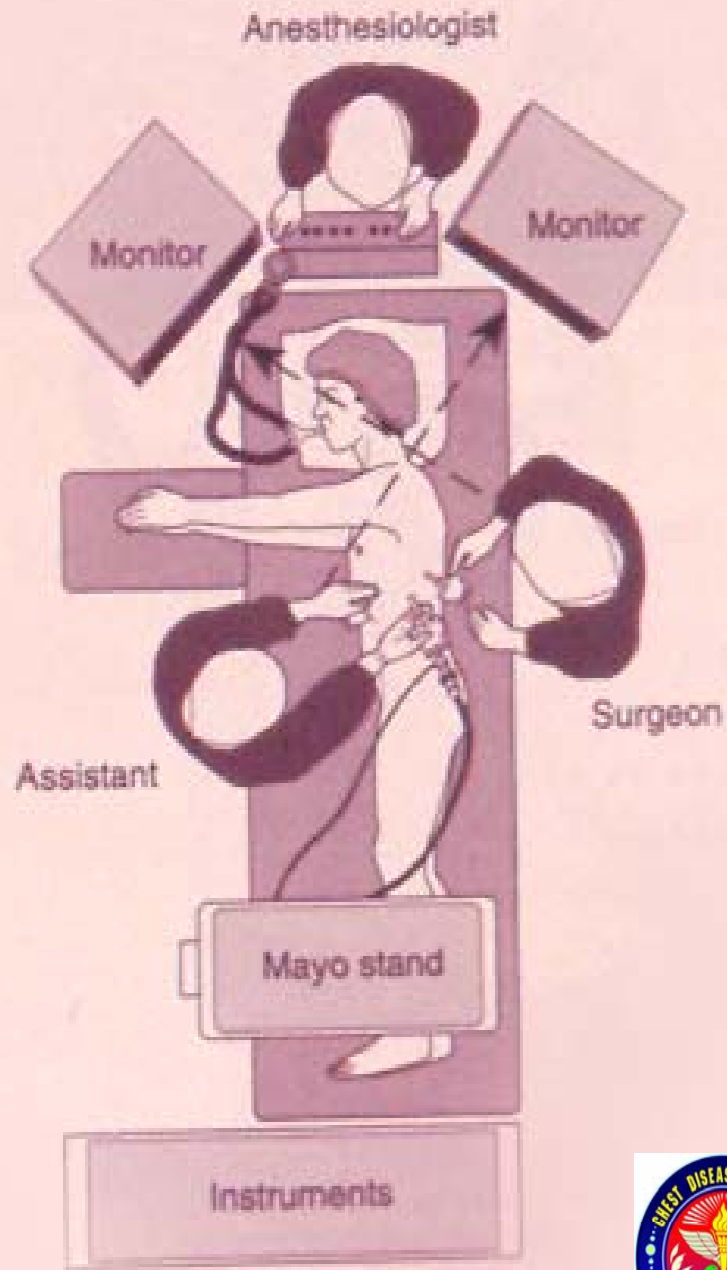


FIGURE 3-1



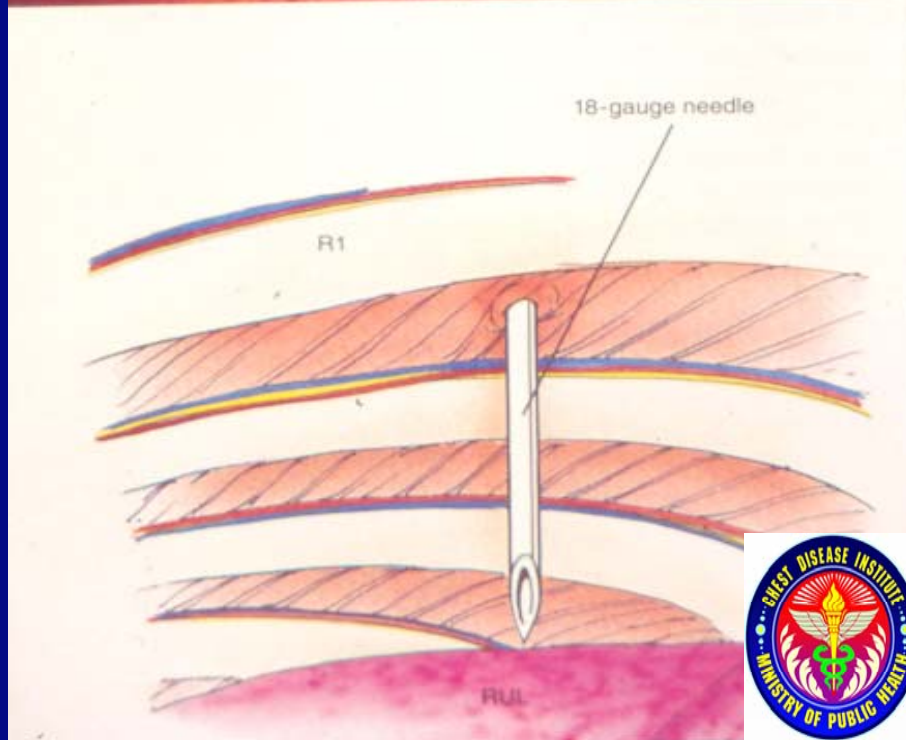
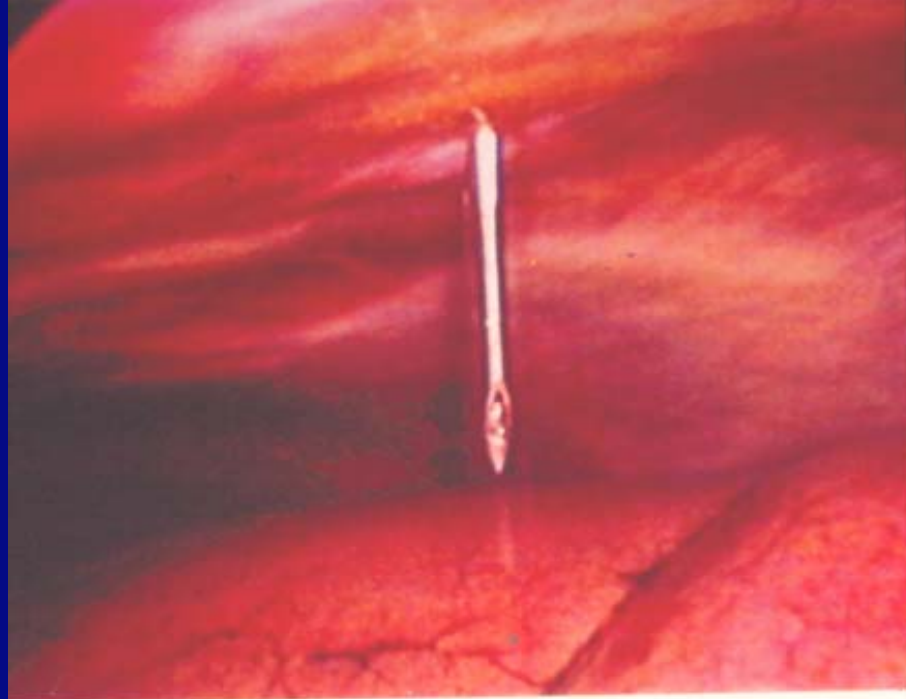


0° operating scope

0° end-viewing scope

30° angled-viewing scope







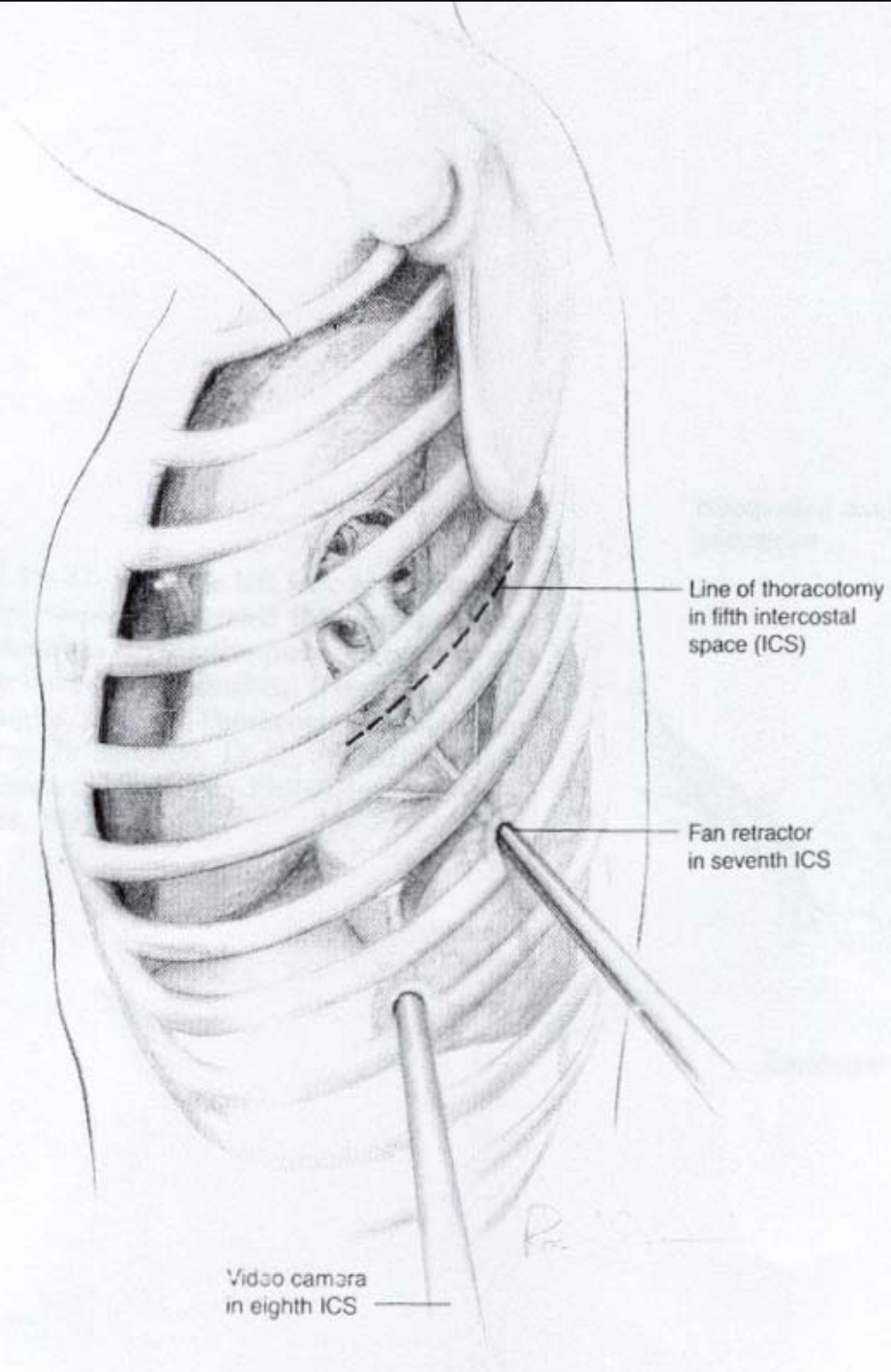


FIGURE 59-35. Trocars are placed to facilitate the camera and retractor. The *dashed line* shows the line of thoracotomy. (From Hsu, C.-P., and Douglas, J. M., Jr.: Thoracoscopic pulmonary lobectomy. In Sabiston, D. C., Jr. [ed]: Atlas of Cardiothoracic Surgery. Philadelphia, W. B. Saunders, 1995.)



FIGURE 59-36. The *dashed line* shows the line of division of the common basal artery. (From Hsu, C.-P., and Douglas, J. M., Jr.: Thoracoscopic pulmonary lobectomy. In Saviston, D. C., Jr. [ed]: Atlas of Cardiothoracic Surgery. Philadelphia, W. B. Saunders, 1995.)

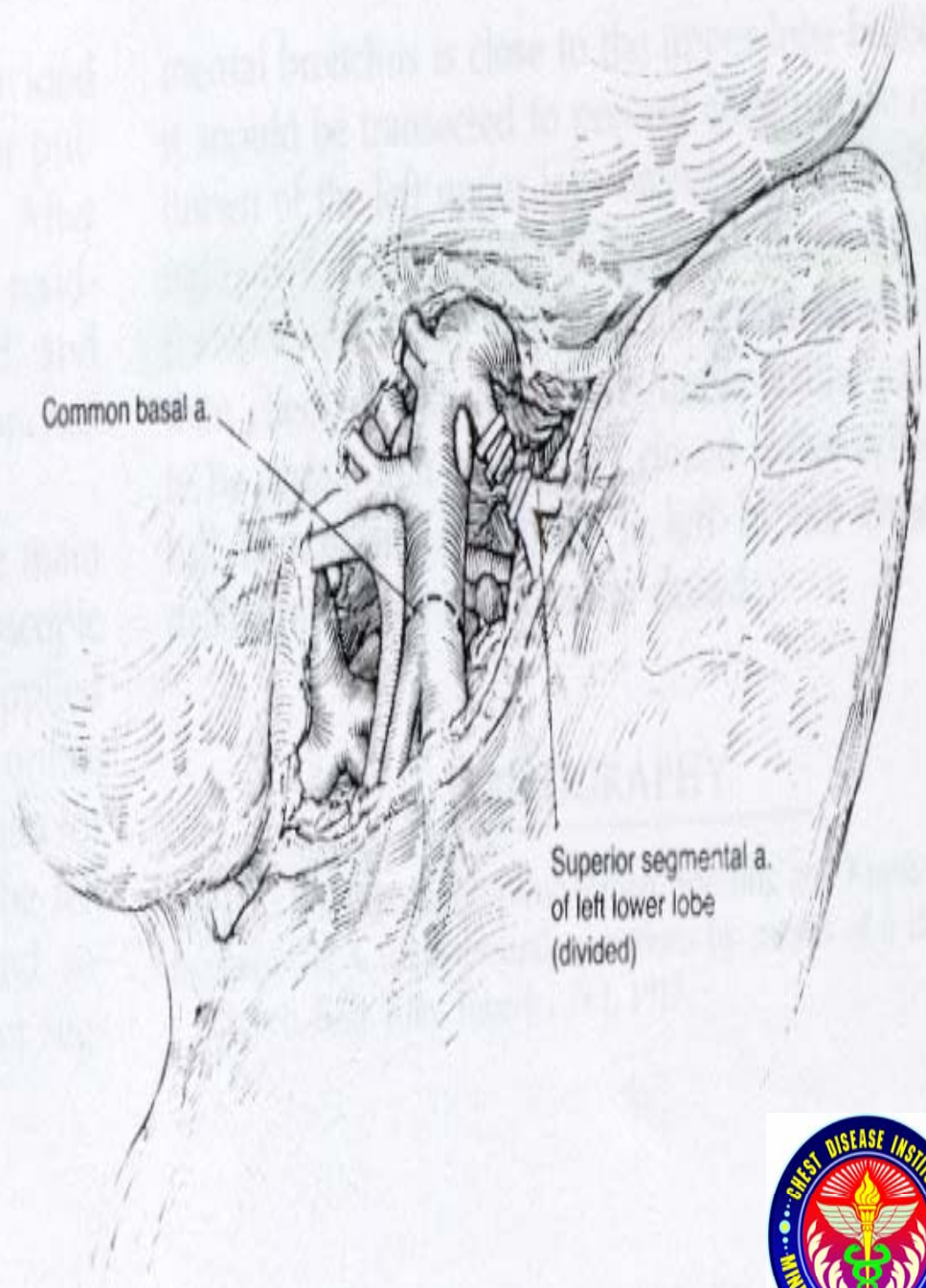
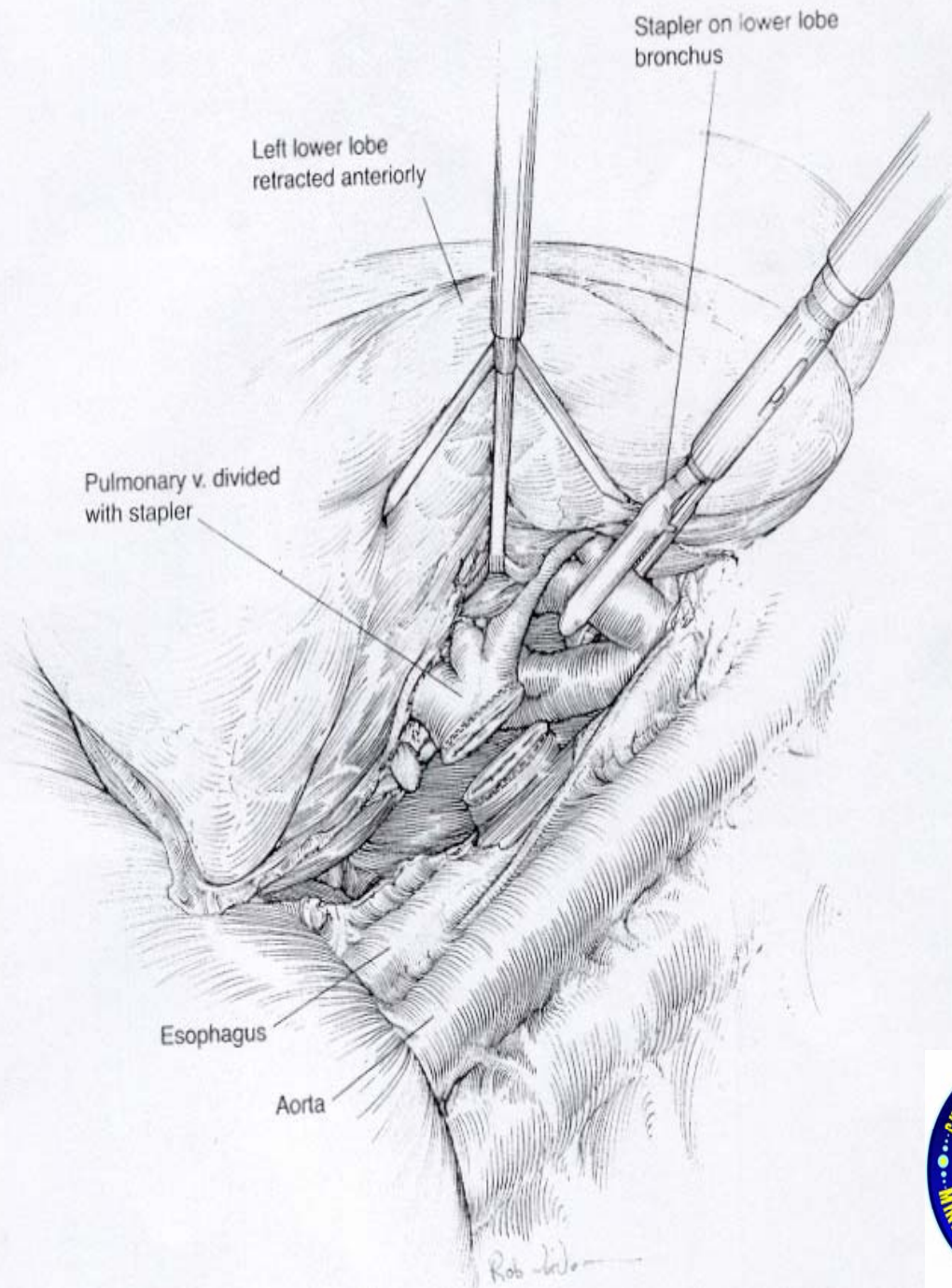
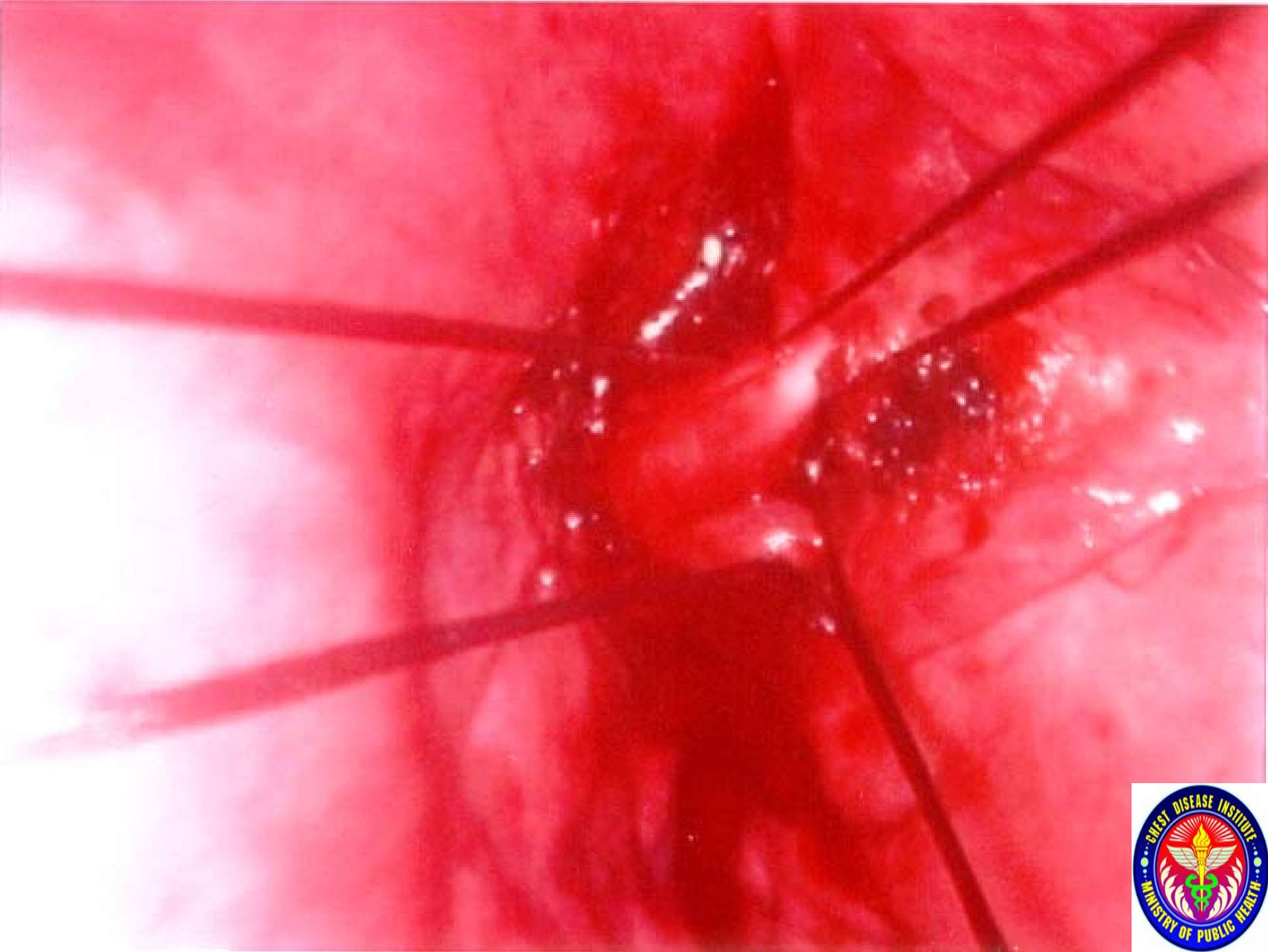
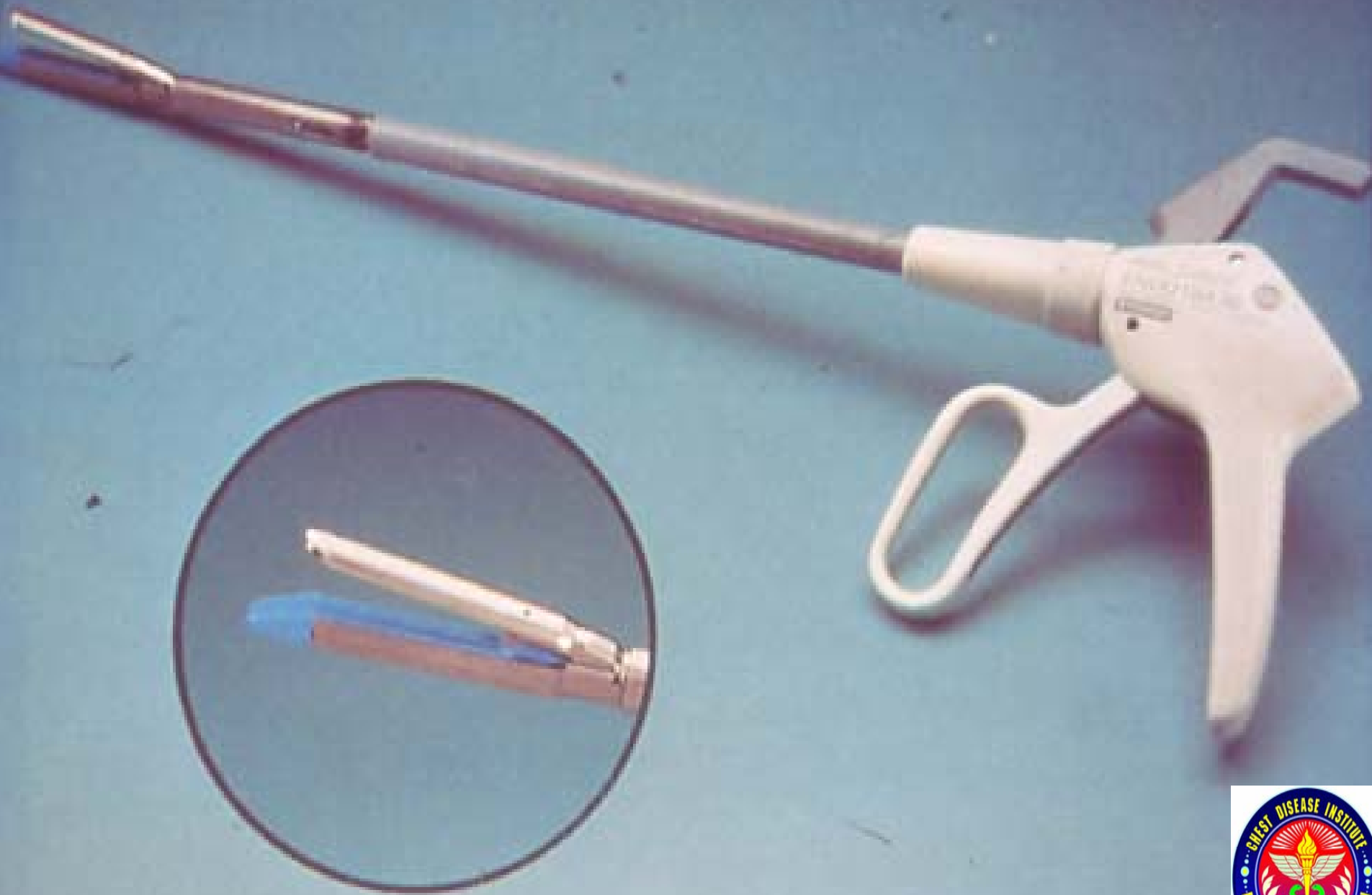


FIGURE 59-37. With the left lobe retracted anteriorly, the stapler is inserted through the access thoracotomy to divide the pulmonary vein and then the lower lobe bronchus. (From Hsu, C.-P., and Douglas, J. M., Jr.: Thoracoscopic pulmonary lobectomy. In Sabiston, D. C., Jr. [ed]: Atlas of Cardiothoracic Surgery. Philadelphia, W. B. Saunders, 1995.)

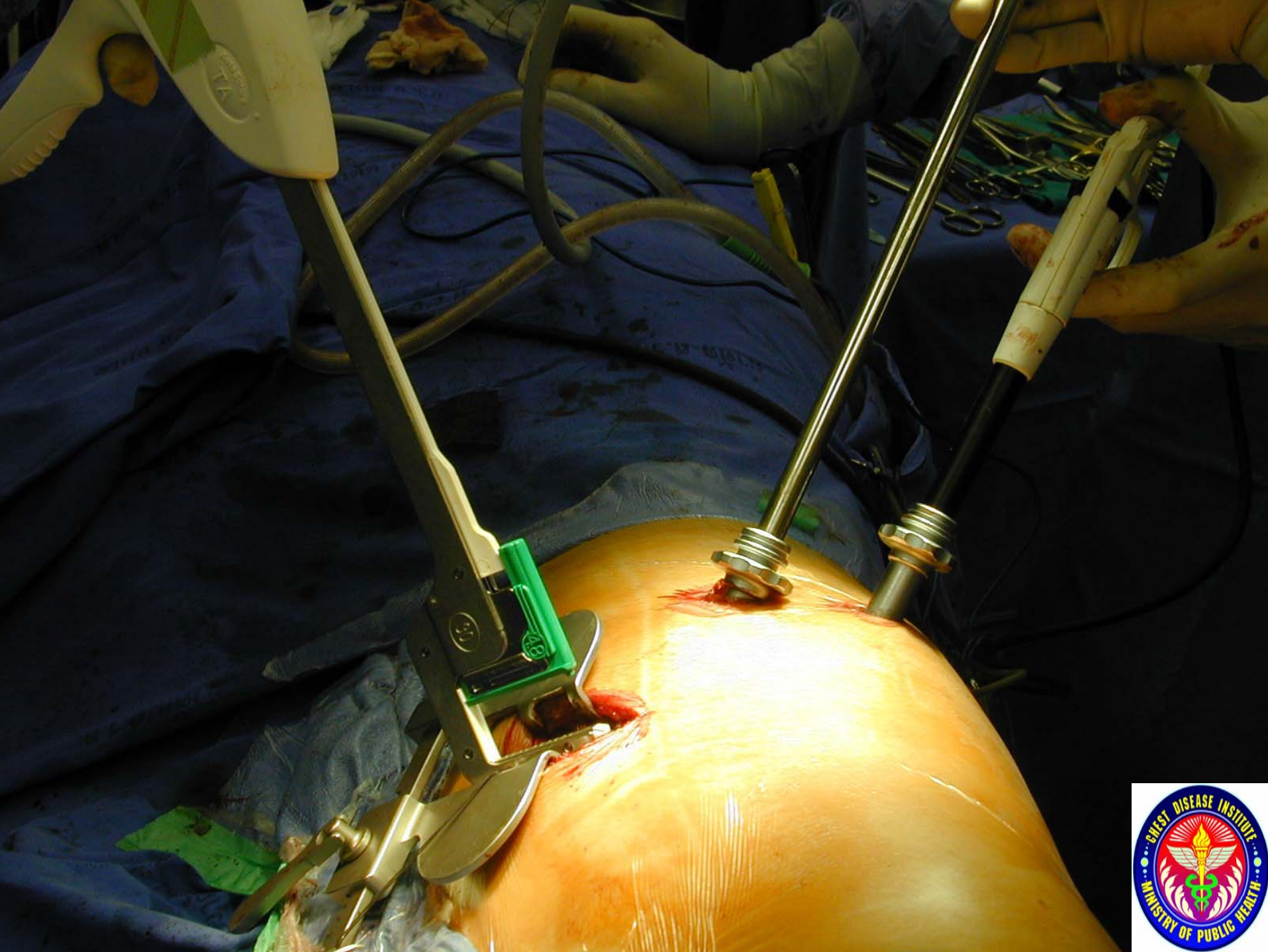


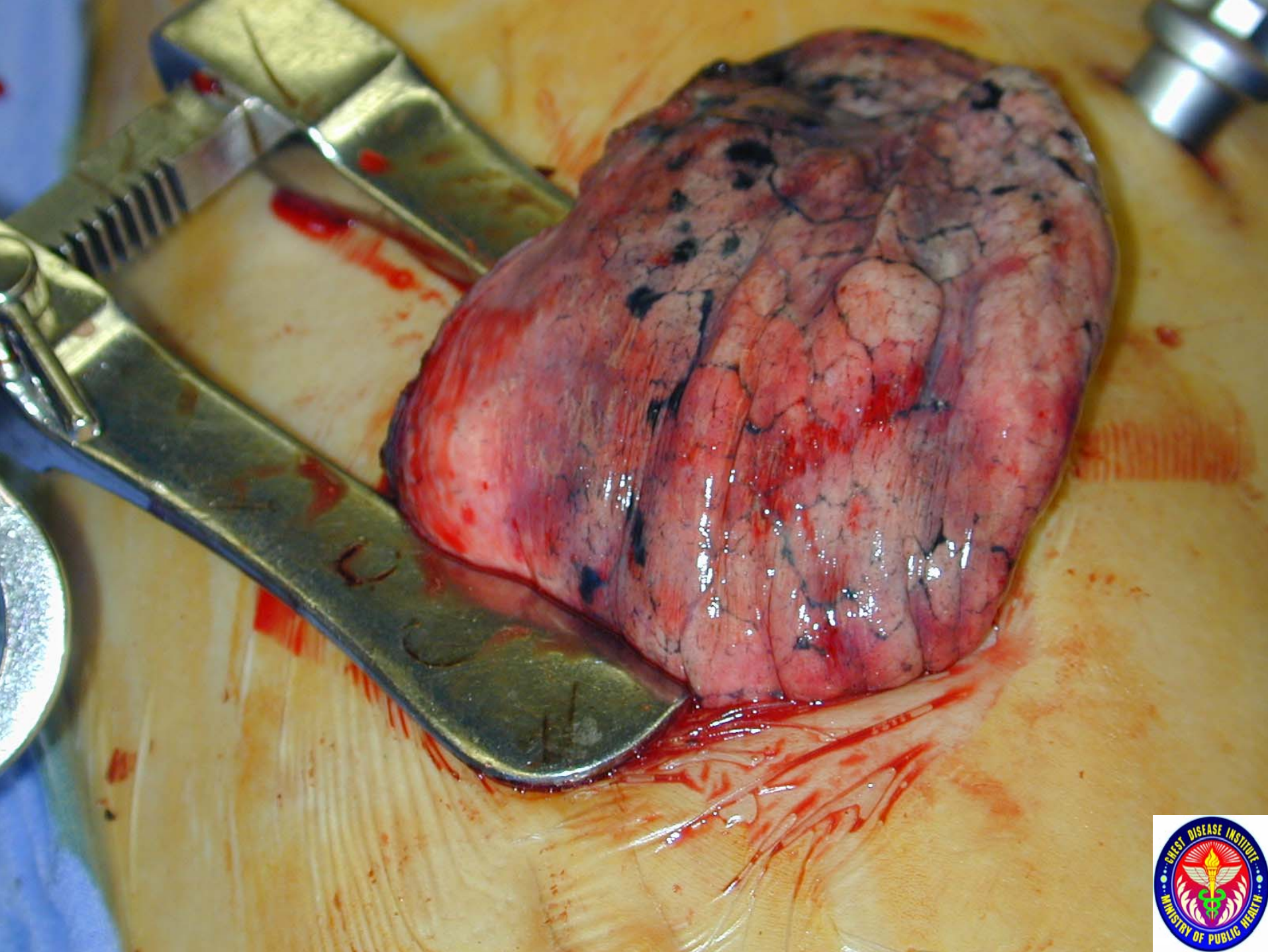


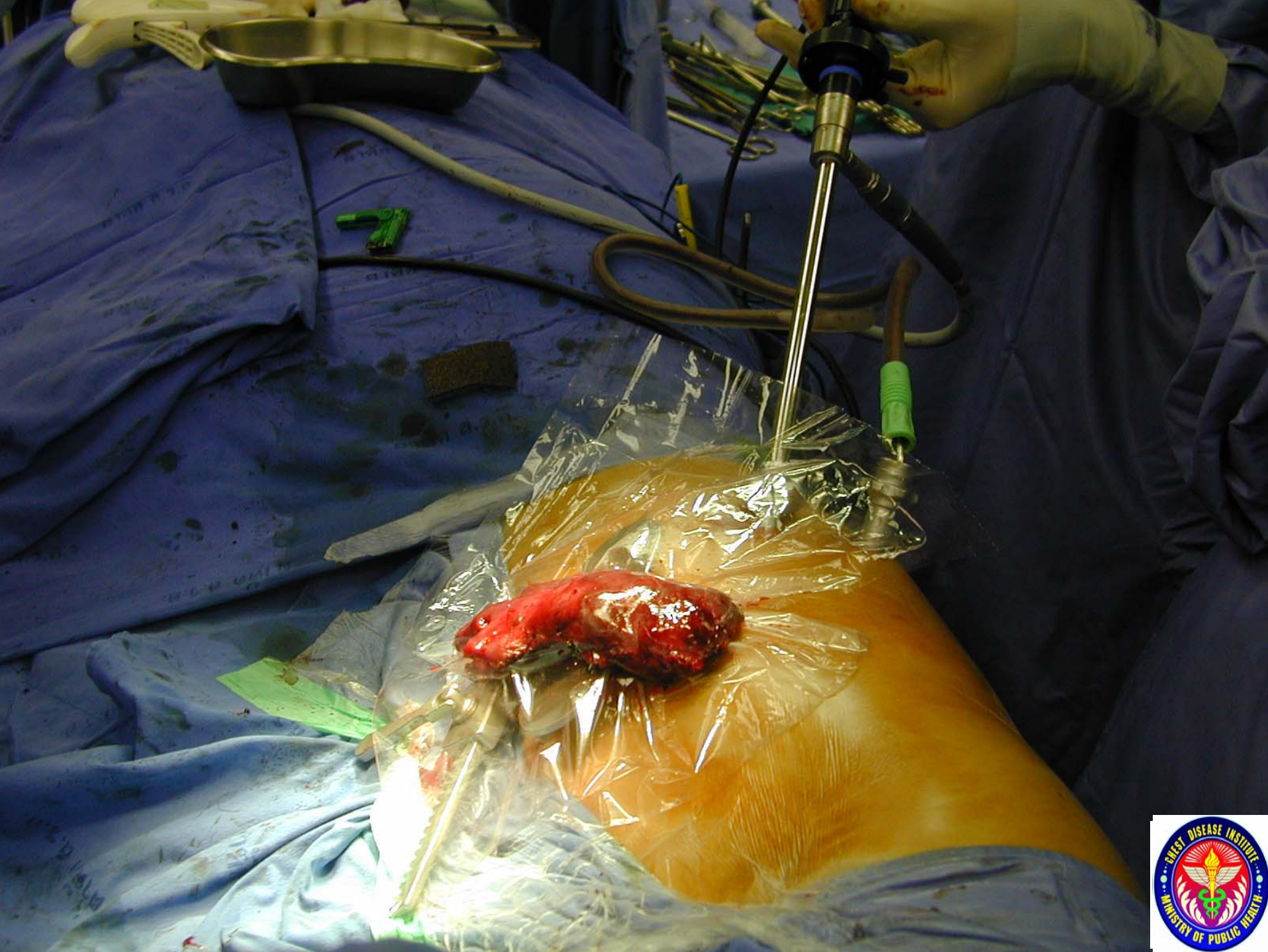








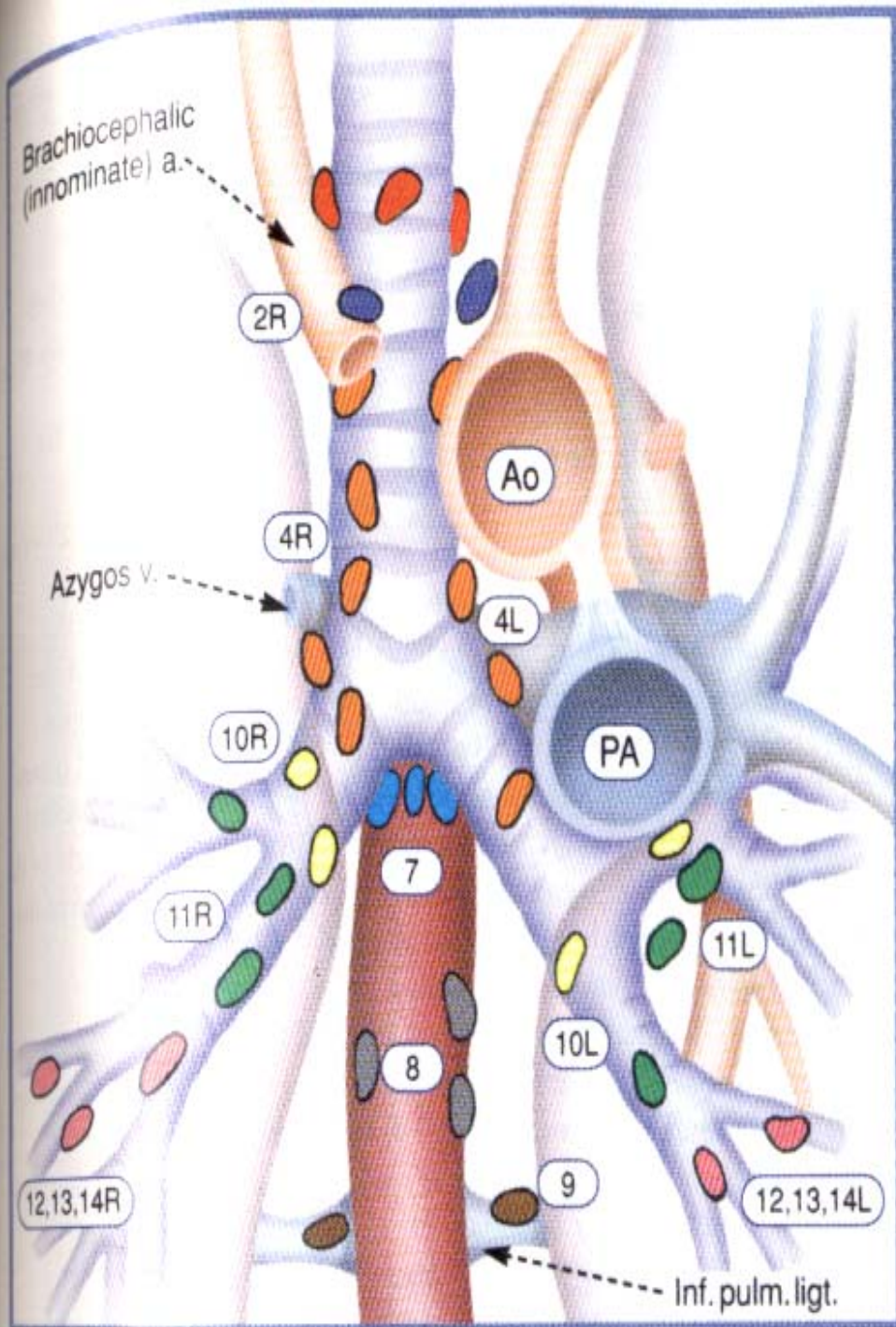






HM 36-28-19





Superior Mediastinal Nodes

- 1 Highest Mediastinal
- 2 Upper Paratracheal
- 3 Pre-vascular and Retrotracheal
- 4 Lower Paratracheal (including Azygos Nodes)

N_2 = single digit, ipsilateral

N_3 = single digit, contralateral or supraclavicular

Aortic Nodes

- 5 Subaortic (A-P window)
- 6 Para-aortic (ascending aorta or phrenic)



ผ่าตัด ส.ร.อ.

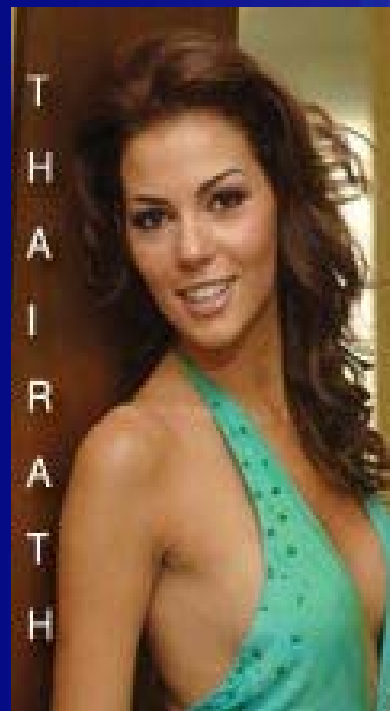
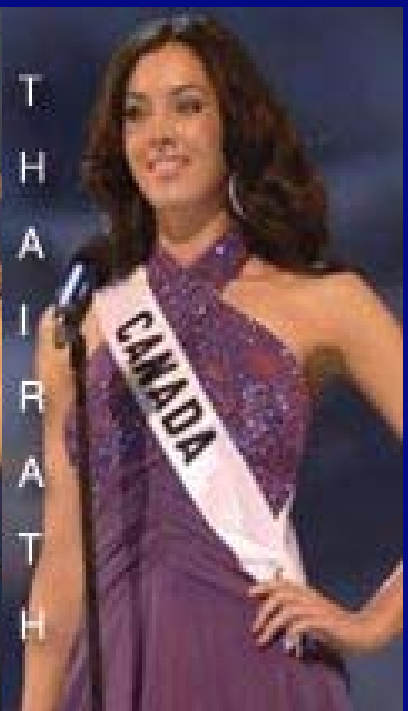
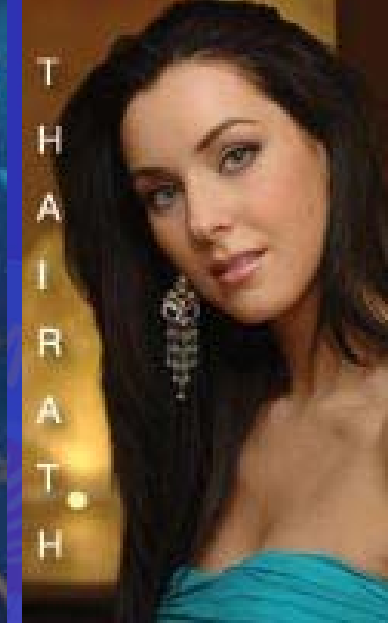




มหาวิทยาลัยราชภัฏวชิราวุฒวิทยาลัย









Major lung resection

Attempt in 60 patients successful 50 cases

Failed 10 cases

- Adhesion 8
- Incomplete fissure 2
- Bleeding 1
- Node 1

Conversion 10/60 (16.7%)



Result from literature

Source	No of pts	Conversion(%)	5 yrs survival(%)
• Yim 1998	266	19.5	85
• McKenna 1998	212	7	76
• Lewis 1999	250	Not mention	92
• Kaseda 2000	204	11.7	97
• Sugi 2000	48	6.1	90
• Walker 2003	158	13.4	77.9
• Roviara 2003	176	23	63.6
• Gharagozloo 2003	179	0	85
• Ohtsuka 2004	106	10	85



Operation time

1 hr 30 min -- 5 hr 30 min
mean 3 hr 42.6 min

Bleeding

mean 555.3 ml

ICD

2-37 days mean 7.6 days

Mass size

1.5-9 cm. mean 2.7 cm.



OPERATION

RLL	12	RUL	11
RML	3	RLL+RML	1
LLL	9	RUL+RML	1
LUL	11	Rt Pneumonectomy	2



Diagnosis Total 47 cases

Bronchiectasis	5	Actinomycosis	1
Tuberculosis	3	Metastatic CA	1
Cryptococcosis	1	Sequestration	1
Primary CA	37	Hamartoma	1
- Adeno CA	19		
- Bronchoalveolar	7		
- Adenosquamous	3		
- Squamous	3		
- Small cell	2		
- Carcinoid	1		
- Large cell	1		

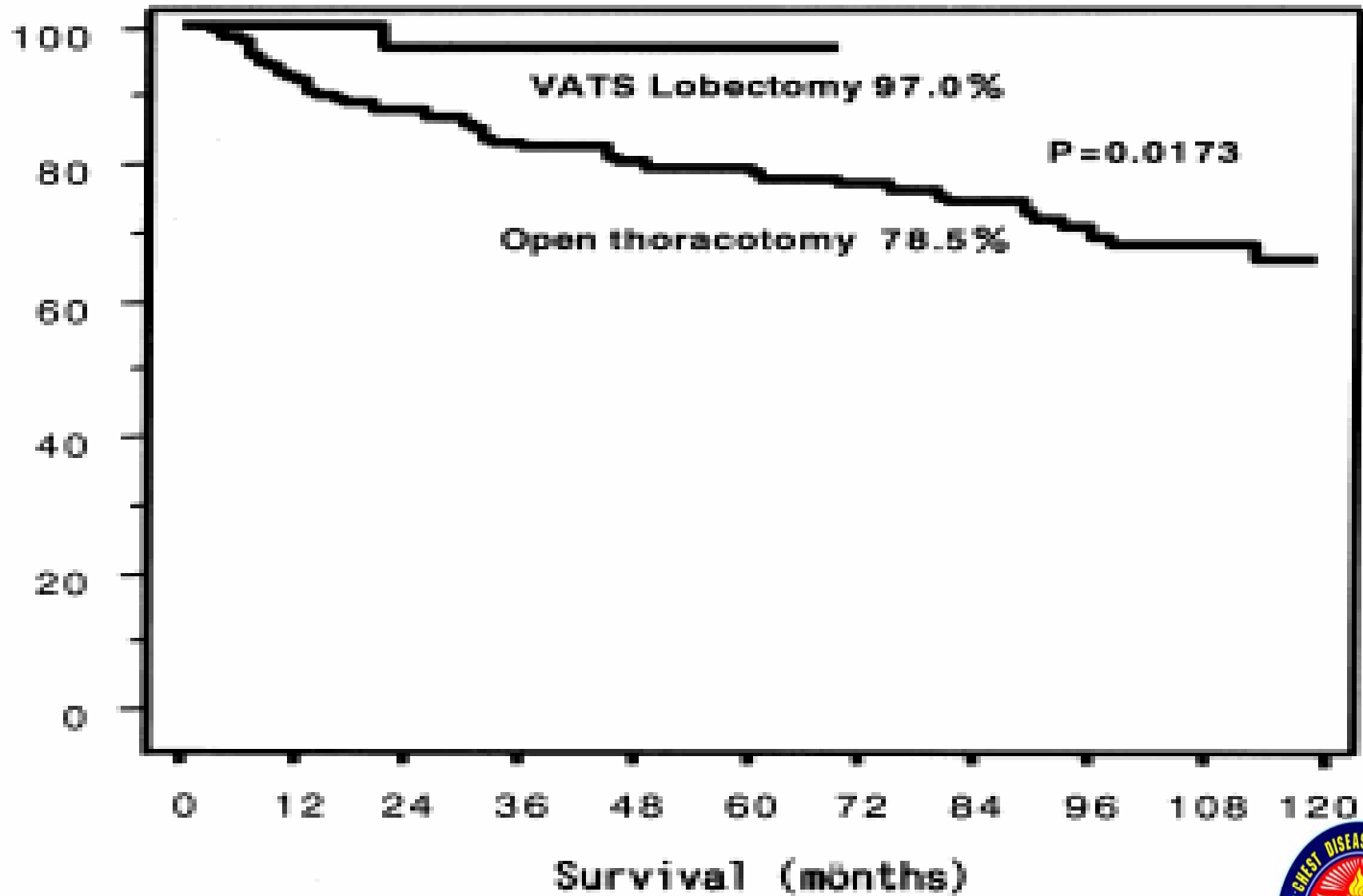


Staging

Ia (T ₁ N ₀)	11
Ib (T ₂ N ₀)	11
IIa (T ₁ N ₁)	-
IIb (T ₂ N ₁)	7
IIIa (T ₁₋₂ N ₂)	8



Survival (%)



Retrospectively compared 5 years survival
stage 1A AdenoCA between 66 VATS pts vs
50 conventional lobectomy 92.4% vs. 86.9%
p = 0.98

Tatsumi A J Thorac Cardiovasc Surg 2003;51(12):646-50.



Prospective study between 48 VATS patients and 52 conventional patients found 5 year survival rate 90% and 85% (p=0.74)



Midterm result

	1 yr(%)	3yr(%)
Stage IA (10 pts)	100	100
Stage IB (9 pts)	100	66.7
Stage IIB (7 pts)	66.7	
Stage IIIA (8 pts)	66.7	33.3
Total (34 pts)	85.1	64.3



Lung Cancer (Chest Disease Institute 10 years experience) 249 patients

Stage	Survival rate (%)		
	1 yr	3 yr	5 yr
IA (24 pts)	91.6	90	75
IB (106 pts)	83.9	82.3	70.5
IIA (0 pts)			
IIB (22 pts)	68.2	50	25
IIIA (51 pts)	86.3	46.3	27.6
IIIB (5 pts)	40	20	0
Total (208 pts)	82.7	67.4	47.9



Midterm result

	1 yr(%)	3yr(%)
VATS		
Stage IA,B (19 pts)	100	70
Conventional		
Stage IA,B (130 pts)	85.3	83.7





Stage III A Non-small Cell Lung Cancer (NSCLC IIIA)

- Neoadjuvant therapy ; North American Intergroup 0196 trial (2005) 396 pts randomized 2 cycle cisplatin/ etoposide and 45- Gy radiotherapy followed by surgery vs 2 cycle cisplatin/ etoposide and 61- Gy radiotherapy higher mortality in surgical gr (7.9% /2.1%) but better 5-yr survival in complete clearing of LN (41% / 20.3%)

Robinson L, et al. Chest (Supplement) 2007 Sep; 132(3):243s-265s.



Role of surgery in SCLC

- All limited SCLC patients with T 1-2 N 0
- Stage II SCLC that response to initial chemotherapy
- Little role for patients stage III tumor even in well response to chemotherapy.
- Combined SCLC and NSCLC.

Waddell TK Thorax Surg Clin 2004; 14(2): 271-281





Thank you

Advance Lung Cancer

- **Locally Advance Non Small Cell Lung Cancer (NSCLC)**
- **Distant metastatize lung cancer**
- **Small Cell Lung Cancer (SCLC)**



TABLE 32.1. TNM DESCRIPTORS
Primary Tumor (T)

TX	Primary tumor cannot be assessed, or tumor proven by the presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy
T0	No evidence of primary tumor
Tis	Carcinoma <i>in situ</i>
T1	Tumor 3 cm or less in greatest dimension, surrounded by lung or visceral pleura, without bronchoscopic evidence of invasion more proximal than the lobar bronchus,* (i.e., not in the main bronchus)
T2	Tumor with any of the following features of size or extent: More than 3 cm in greatest dimension Involves main bronchus, 2 cm or more distal to the carina Invades the visceral pleura Associated with atelectasis or obstructive pneumonitis that extends to the hilar region but does not involve the entire lung
T3	Tumor of any size that directly invades any of the following: chest wall (including superior sulcus tumors), diaphragm, mediastinal pleura, parietal pericardium; or tumor in the main bronchus less than 2 cm distal to the carina, but without involvement of the carina; or associated atelectasis or obstructive pneumonitis of the entire lung
T4	Tumor of any size that invades any of the following: mediastinum, heart, great vessels, trachea, esophagus, vertebral body, carina; or tumor with a malignant pleural or pericardial effusion,** or with satellite tumor nodule(s) within the ipsilateral primary tumor lobe of the lung

Regional Lymph Nodes (N)

NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis to ipsilateral peribronchial and/or ipsilateral hilar lymph nodes, and intrapulmonary nodes involved by direct extension of the primary tumor
N2	Metastasis to ipsilateral mediastinal and/or subcarinal lymph node(s)
N3	Metastasis to contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s)

Distant Metastasis (M)

MX	Presence of distant metastasis cannot be assessed
M0	No distant metastasis
M1	Distant metastasis present [†]

TABLE 32.2. STAGE GROUPING—TNM SUBSETS

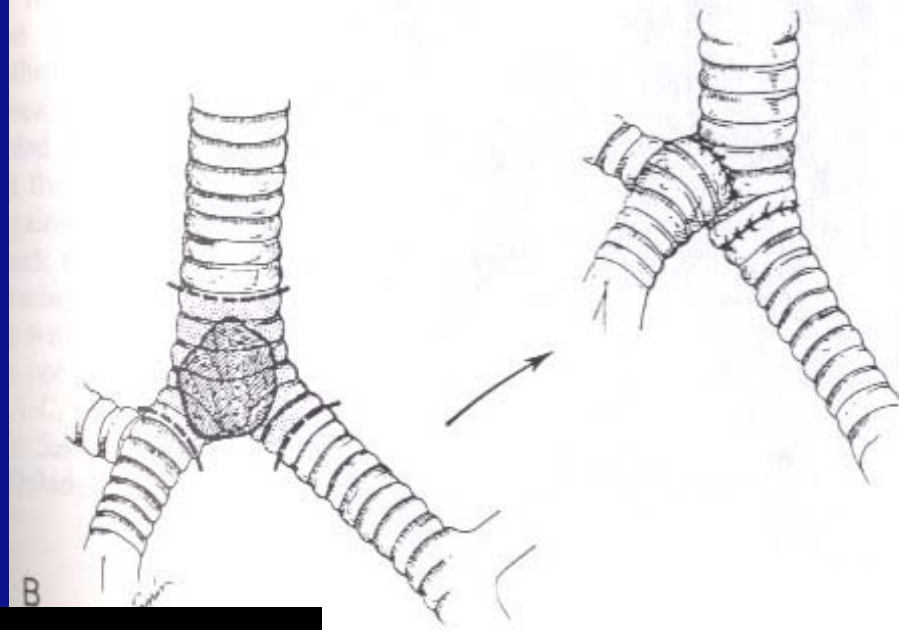
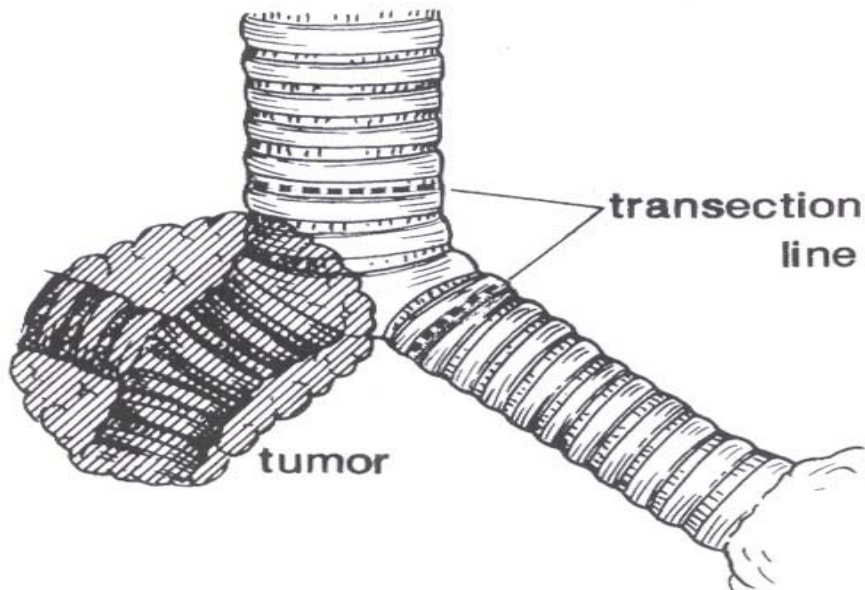
Stage	TNM Subset		
Stage 0	Carcinoma <i>in situ</i>		
Stage IA	T1 N0 M0		
Stage IB	T2 N0 M0		
Stage IIA	T1 N1 M0		
Stage IIB	T2 N1 M0		
	T3 N0 M0		
Stage IIIA	T3 N1 M0		
	T1 N2 M0	T2 N2 M0	T3 N2 M0
Stage IIIB	T4 N0 M0	T4 N1 M0	T4 N2 M0
	T1 N3 M0	T2 N3 M0	T3 N3 M0
	T4 N3 M0		
Stage IV	ANY T ANY N M1		

From Mountain CF. Revisions in the international system for staging lung cancer. *Chest* 1997;111:1710, with permission.

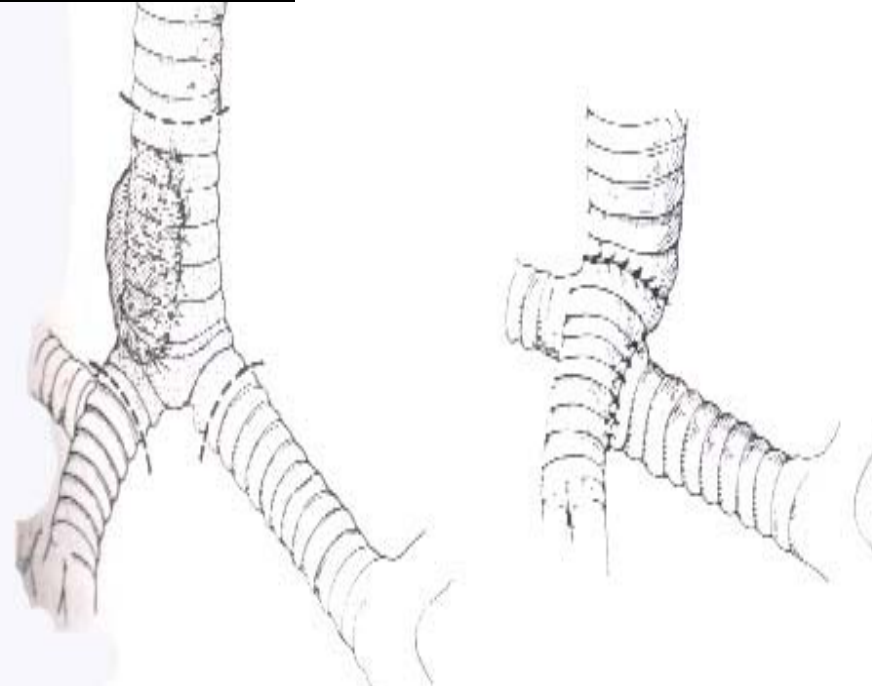
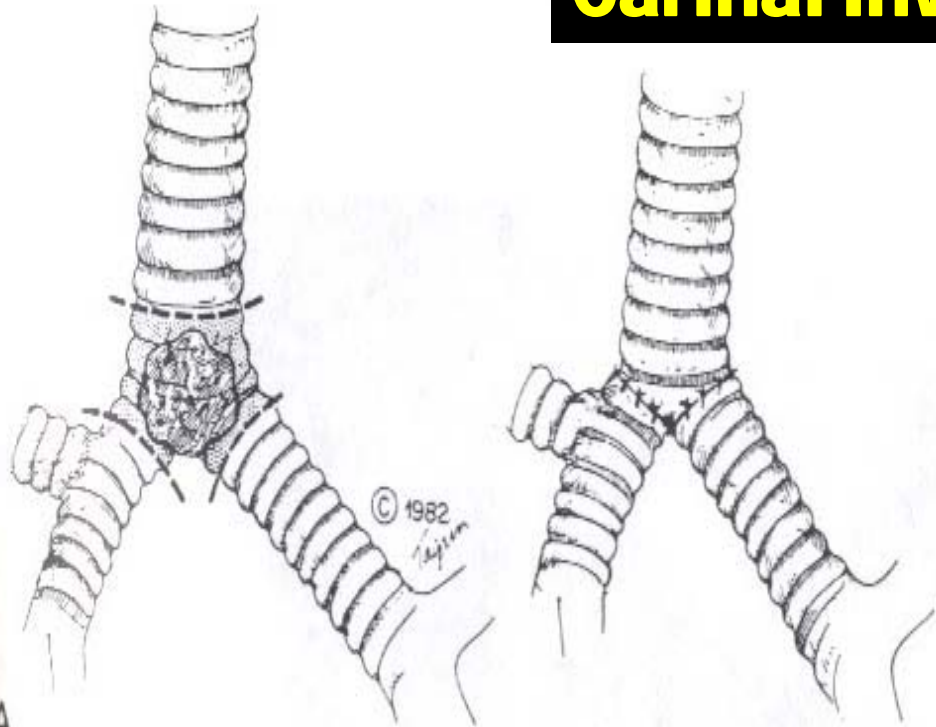
Direct Invasion to mediastinal Structure

- Right or left main pulmonary artery
- Left atrium





Carinal Involvement



Carinal reconstruction

- Perioperative mortality 10 – 24 %
- 5 – year survival rate approximately 20 %
- Major influence factor is mediastinal node involvement
- Local recurrence is well recognized
- Some have advocated neoadjuvant combined chemo and radiotherapy ⁽¹⁾
- The most common cause of death is systemic recurrence

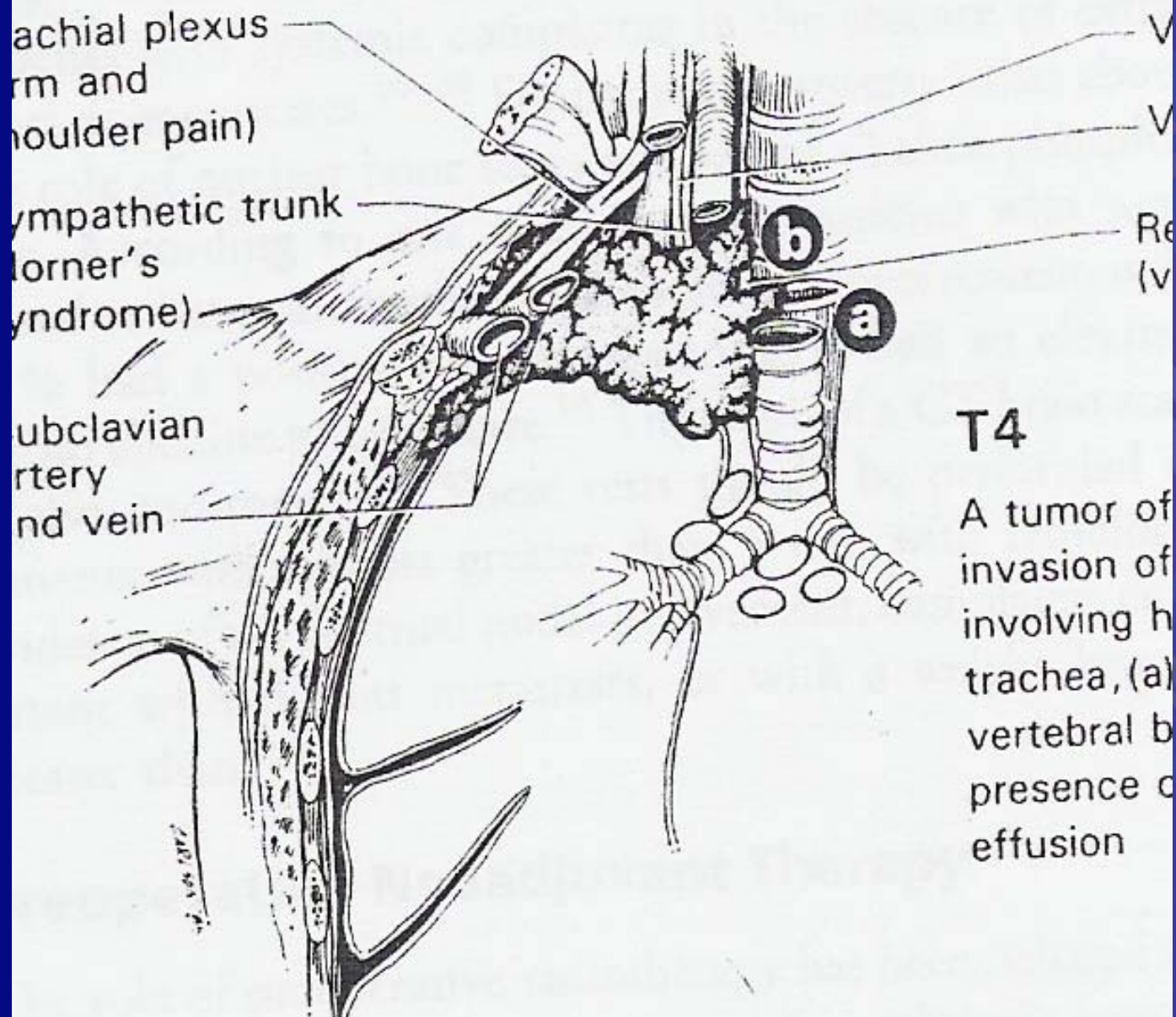
Pancoast Tumor

- Shaw in 1961 introduced classic approach
- Median survival time 22 months, 5 – year survival of 27 % (1)
- Radiation alone good palliation of pain (75 %) but 5 – yr 5 %
- Preoperative chemoradiotherapy followed by surgery has complete resection rate 92 % and local recurrence 33 % (2)
- **Negative prognostic factor**
- N 2 involvement is a major one
- Vertebral body or Subclavian vessel involvement
- The present of Horner syndrome

1. Detterbeck FC. Chest 2003; 123: 244s-258s

2. Rusch VW. Thorac Cardiovasc Surg 2001; 121: 472-483

Pancoast's Syndrome

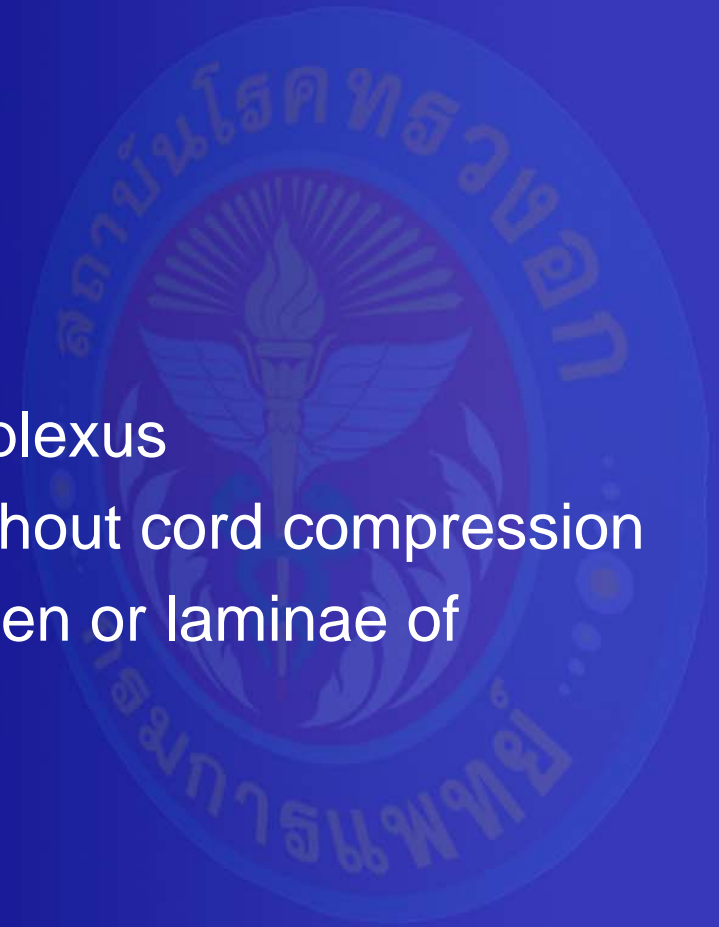


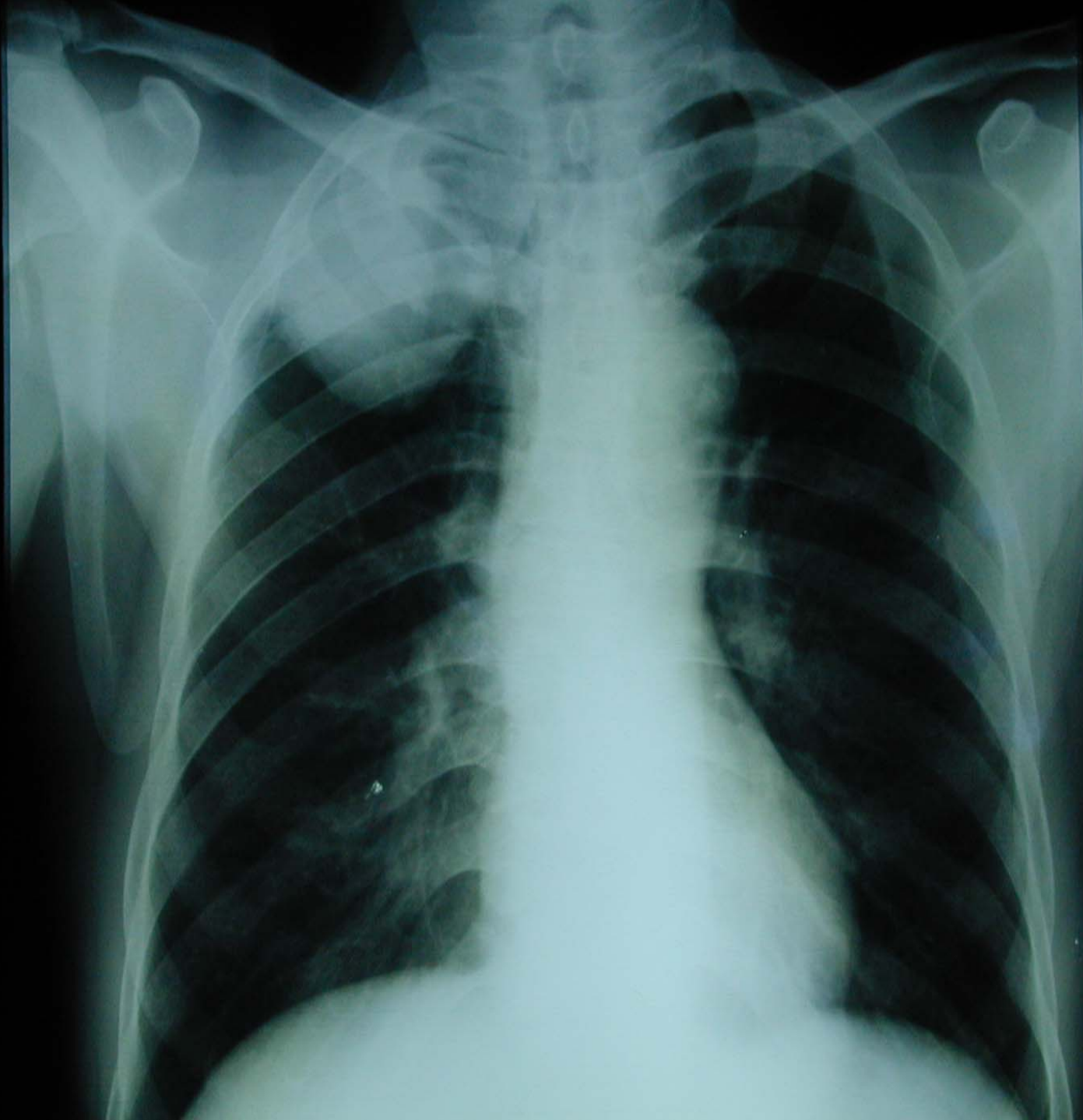
T4

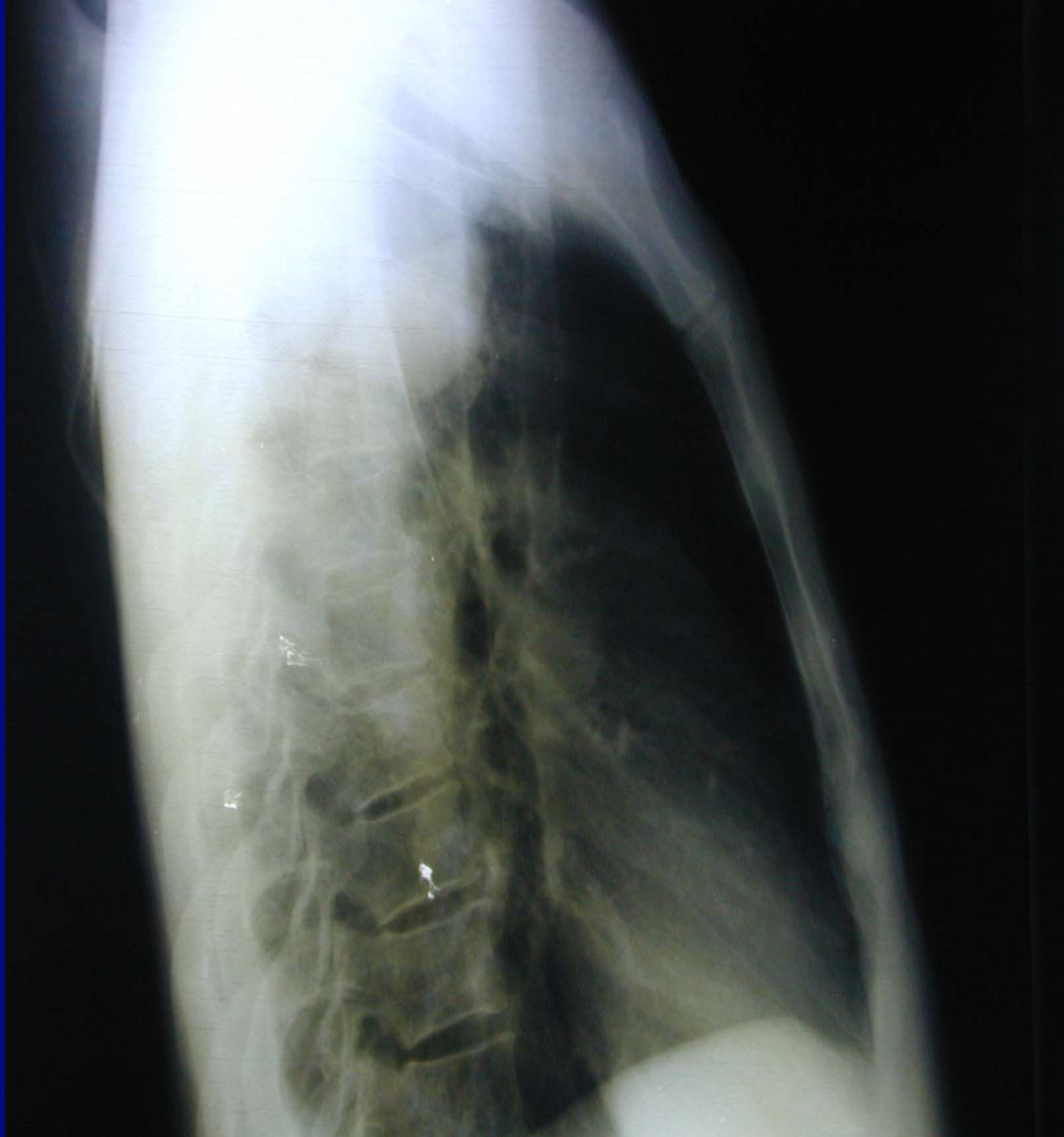
A tumor of invasion of involving h
trachea, (a)
vertebral b
presence o
effusion

Sign of Inoperability

- Distant metastases
- Extensive Involvement of brachial plexus
- Extension into spinal canal with/without cord compression
- Involvement of intervertebral foramen or laminae of thoracic vertebrae
- Metastasis to scalene node



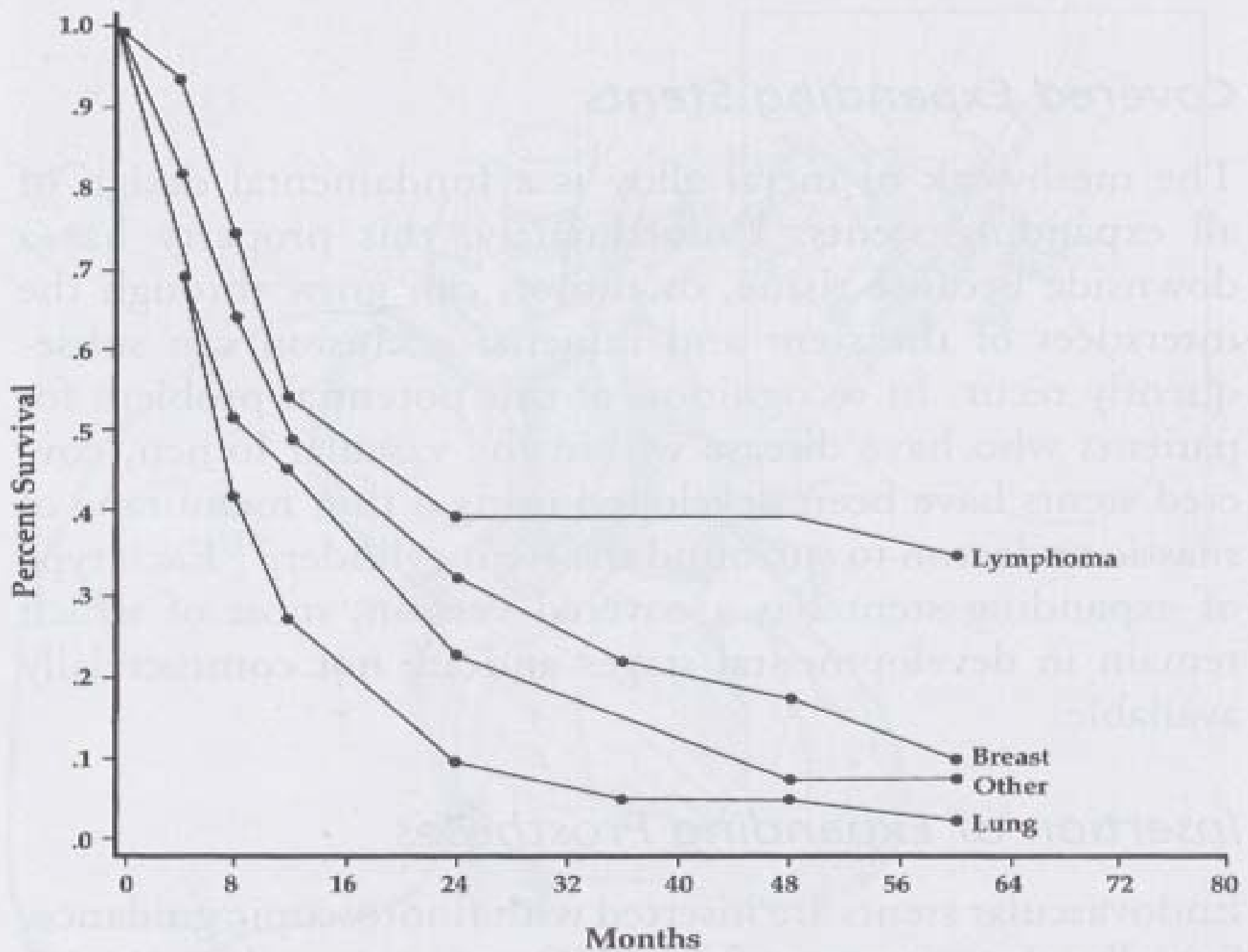


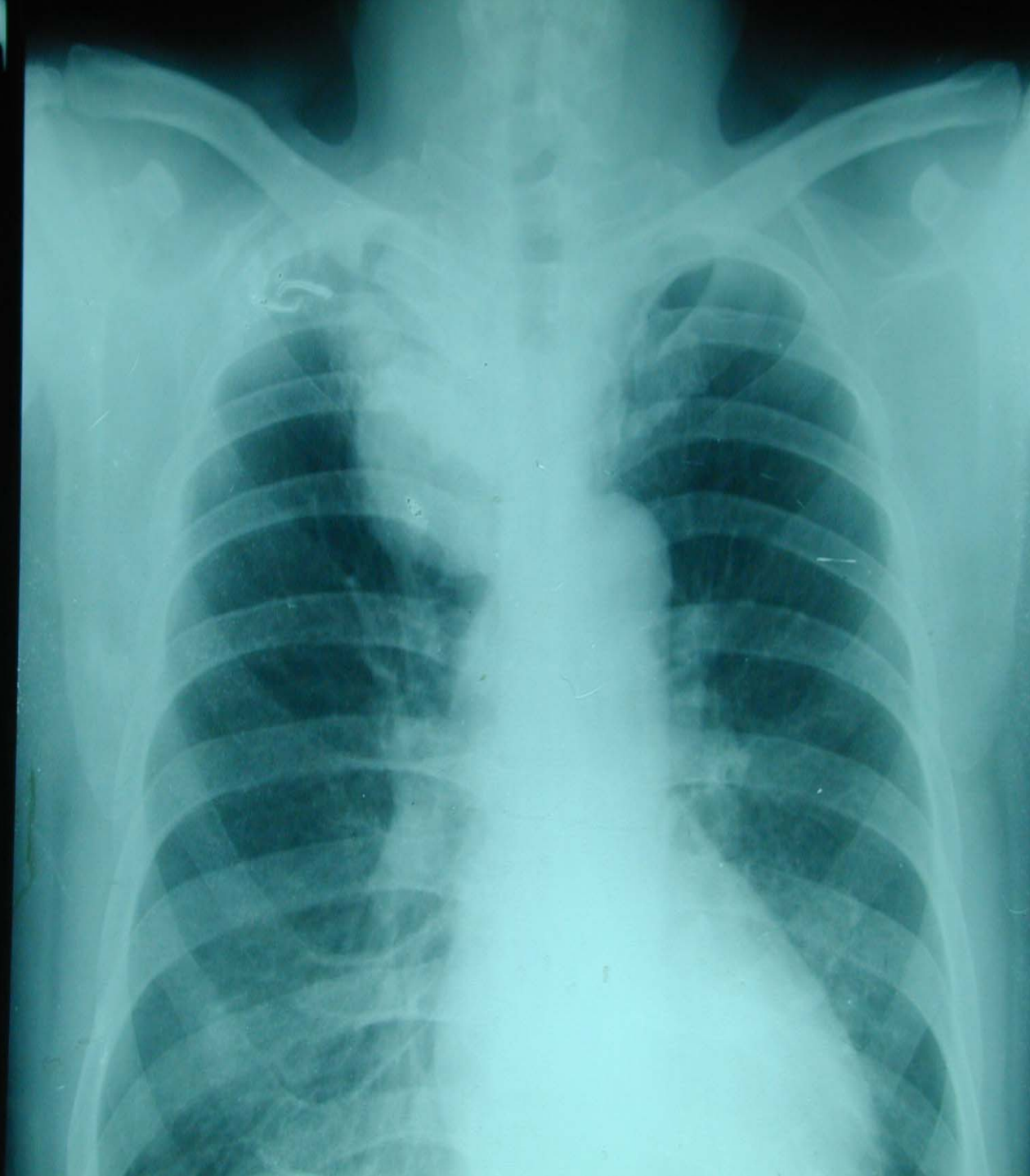


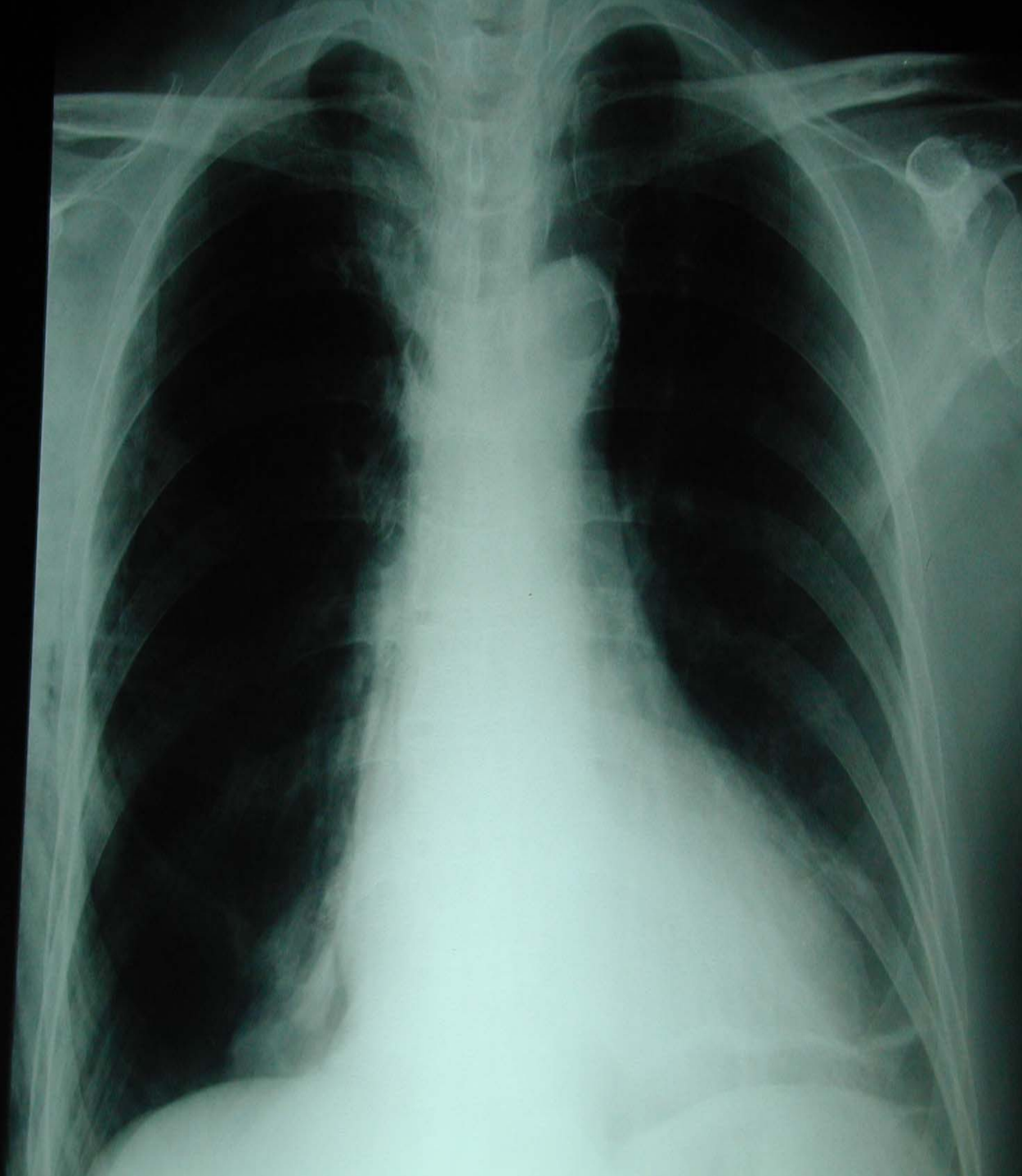
SVC Syndrome

- 97 % secondary to malignancy
- Involvement of SVC has been a criteria of unresectability
- 3 – 5 % of lung cancer
- 10 – 15 % of right side lung cancer











KV 120
eff.mAs 80
mA 240
TI 0.5
GT 0.0
SL 4.0/2.5/15.0
276 7/0
B30f L3C0

Delayed Scans
Flow rate 1.5-2ml/s

A

JURAIPORN P.F 59Y/CXR/#91
GC5784
'05-Jul-1946
05-Jul-2005
17:19:44.25
6 IMA 19
SPI 4
SP -122.5



KV 120
eff.mAs 80
mA 240
TI 0.5
GT 0.0
SL 4.0/2.5/15.0
276 7/0
B30f L3C0

Delayed Scans
Flow rate 1.5-2ml/s

A

Srinagarind Hospital JURAIPORN P.F 59Y/CXR/#91
Volume Zoom GC5784
VA47C '05-Jul-1946
F-SP-CR 05-Jul-2005
17:19:44.51
6 IMA 18
SPI 4
SP -114.5

W 350
C 40

Srinagarind Hospital
Volume Zoom
VA47C
F-SP-CR

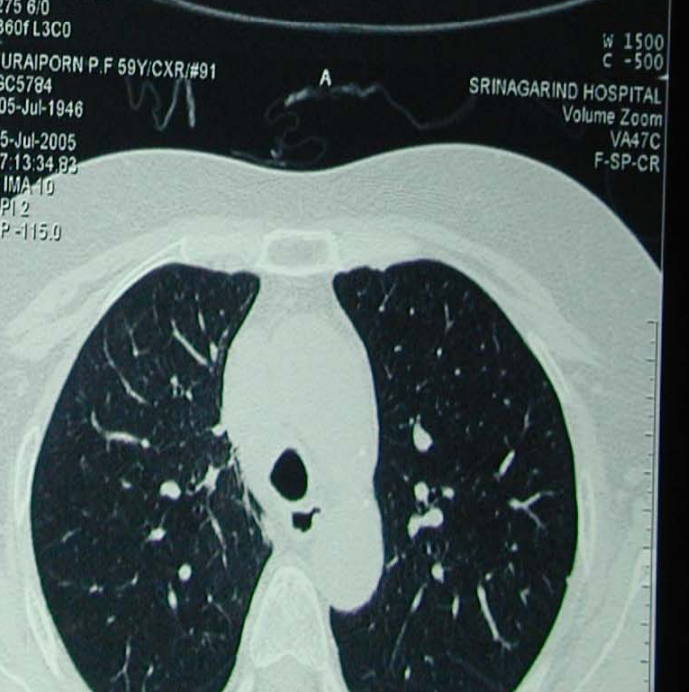
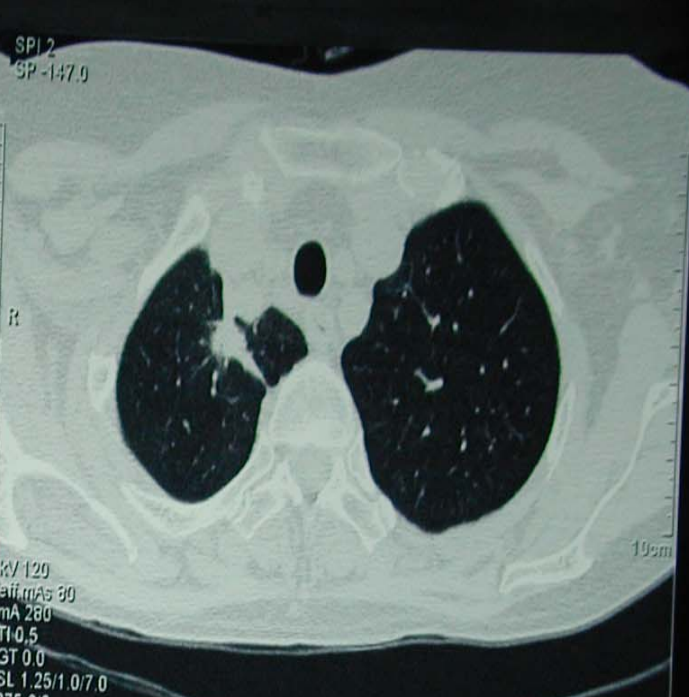
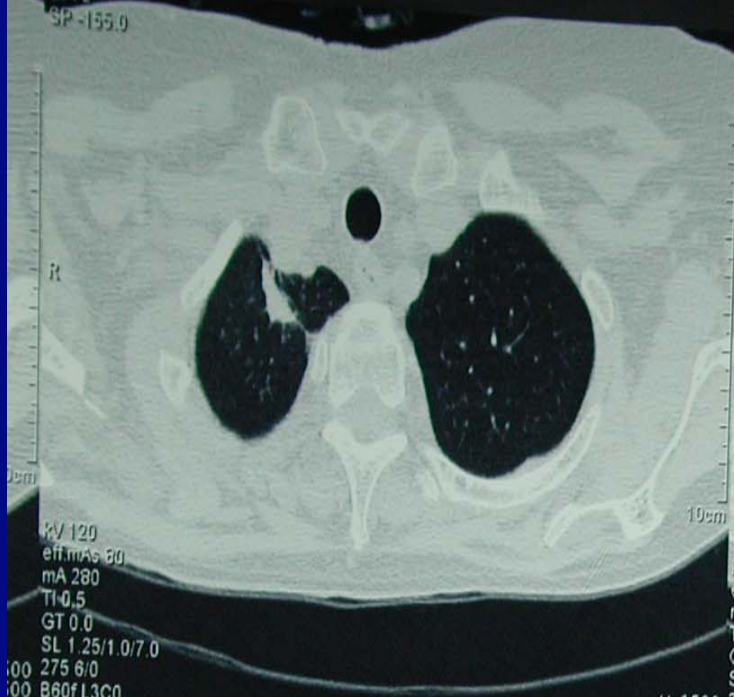


KV 120
eff.mAs 80
mA 240
TI 0.5



KV 120
eff.mAs 80
mA 240
TI 0.5





JURAI PORN P.F 59Y/CXR/#91
GC5784
'05-Jul-1946
05-Jul-2005
17:13:35.40
8 IMA 9
SPI 2
SP -123.0

Srinagarind Hospital
Volume Zoom
VA47C
F-SP-CR
05-Jul-2005
17:13:34.82
8 IMA 10
SPI 2
SP -115.0

Srinagarind Hospital
Volume Zoom
VA47C
F-SP-CR



Choice of surgery

- En bloc removal of the SVC and the tumor
- Surgical bypass
 - SVC to RA appendage
 - Innominate vein to SVC
 - Rt subclavian vein to SVC
 - Lt subclavian vein to RA
 - Jugular vein to RA
 - Extra-anatomical bypass to femoral vein
- Endovascular stent



Enbloc Resection

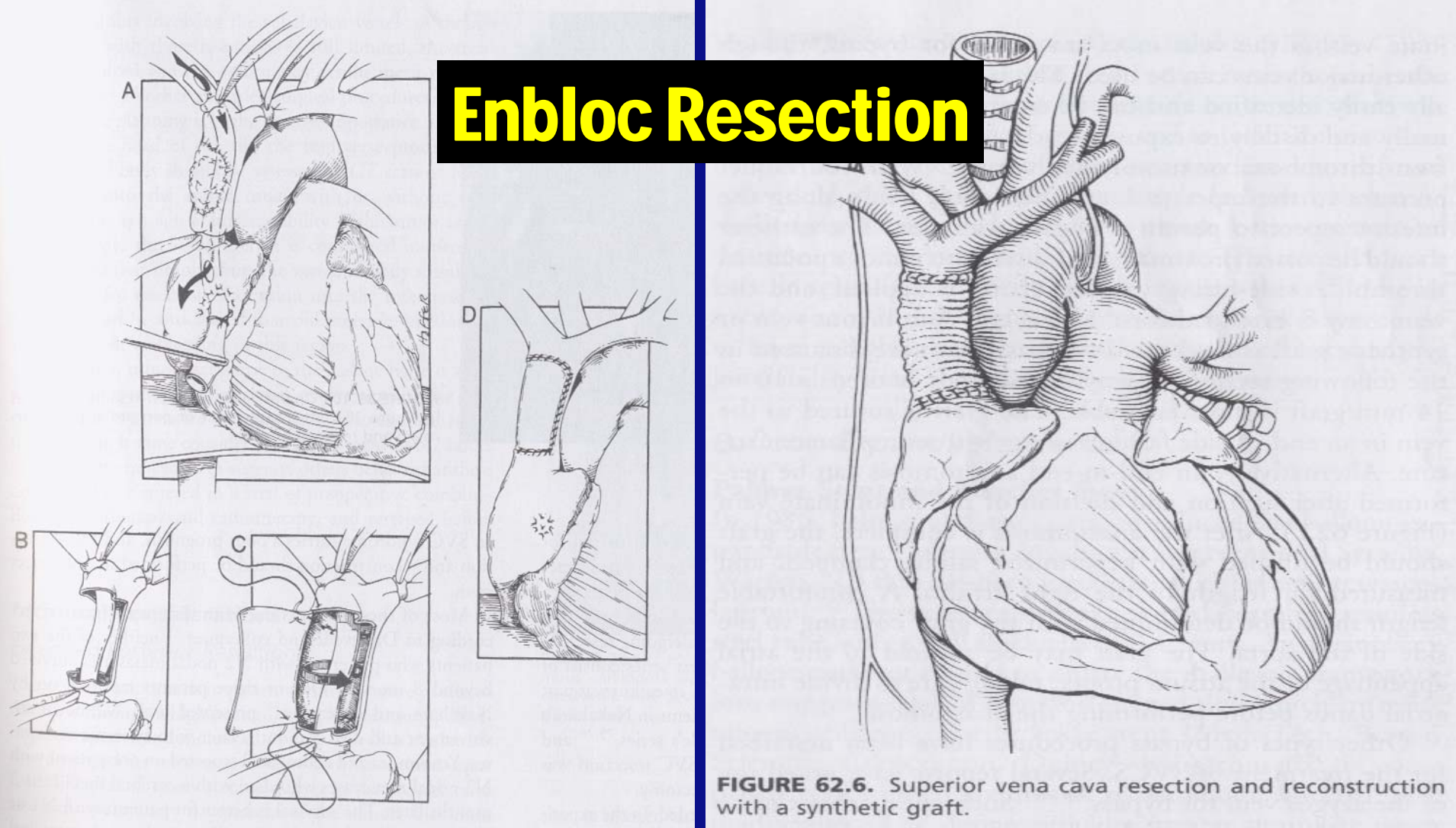


FIGURE 62.6. Superior vena cava resection and reconstruction with a synthetic graft.

- Fewer than 50 cases have been reported
- Low 5 – year survival rate
- Most of the patients die from distant metastases



Bypass Surgery

- Mortality rate 4.4 %
- Average survival 10.8 months while mean survival for conservative treatment 8.2 months

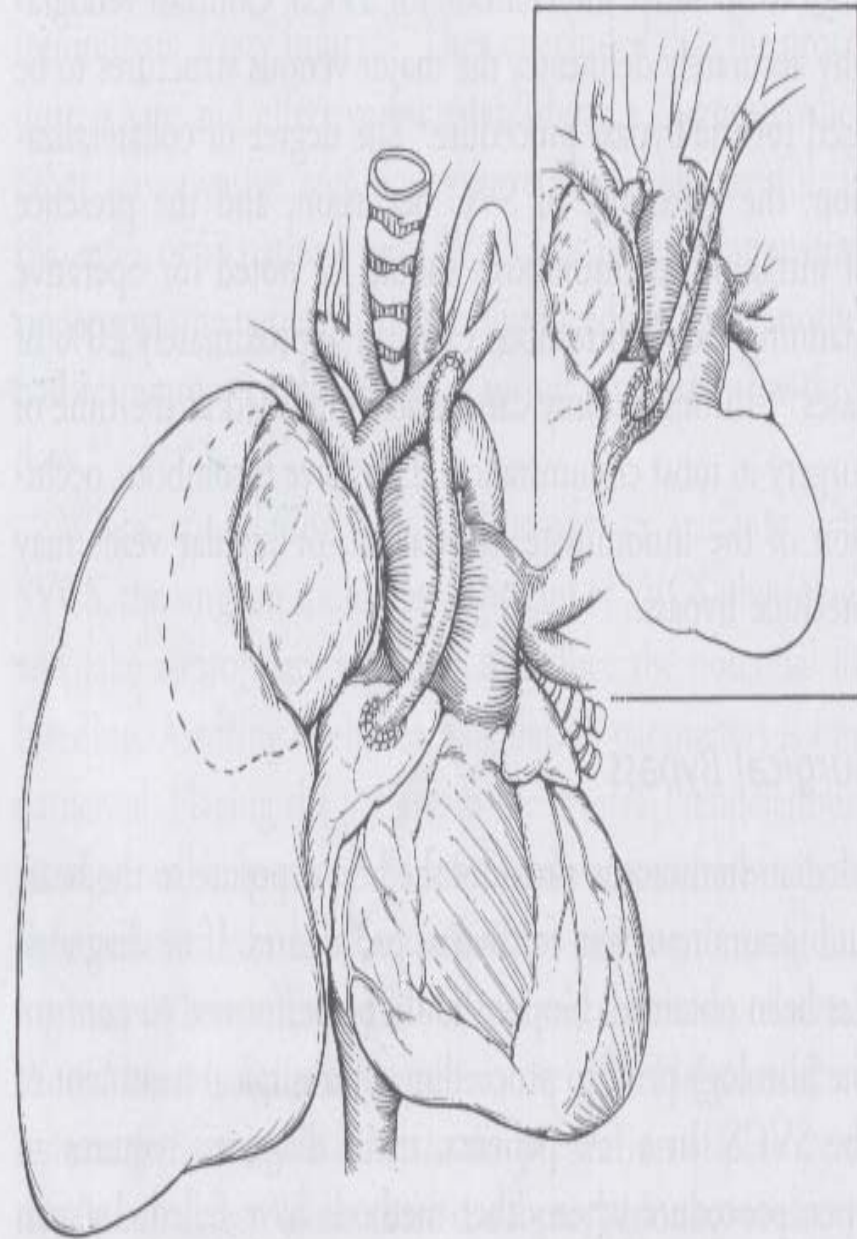


FIGURE 62.7. Innominate vein to right atrial bypass can be performed using autologous vein, synthetic graft, or spiral vein.

Endovascular Stents

- Successful rate 95 %
- Mortality rate 3 %, morbidity 10 %
- Rapid relief of symptom within 6 – 48 hours while
- radiotherapy needs 3-7 days
- Mathias K. Radiology 1998;38:606

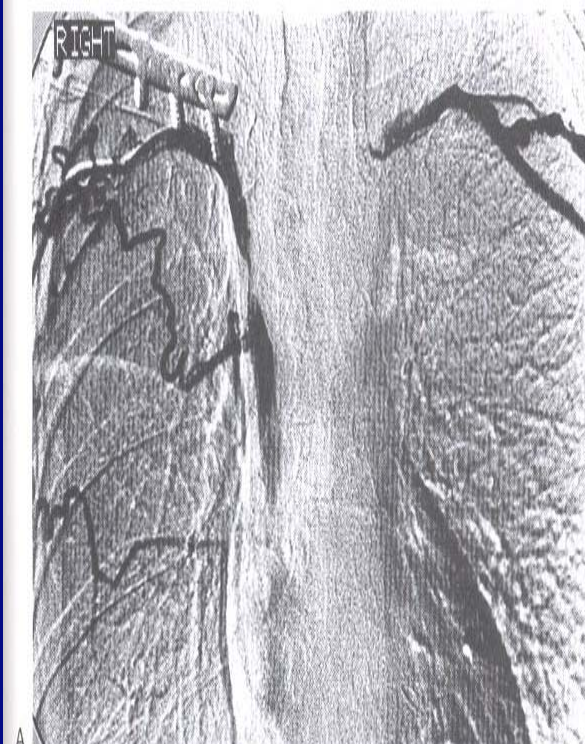
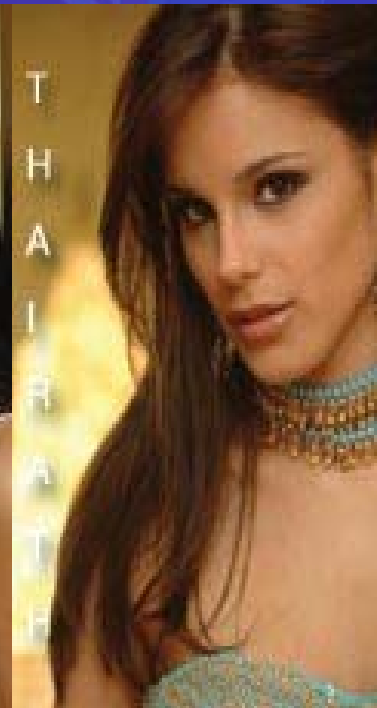
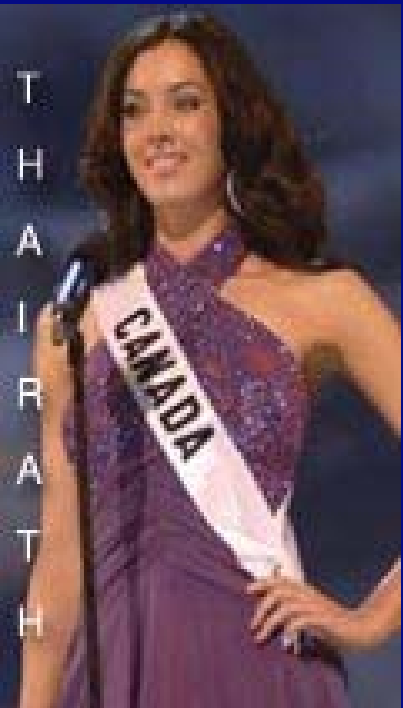


Table 1—Results of Resection of Patients With T4 Involvement From NSCLC*

Structure	Studies (No.)	No. of Patients	Hospital Mortality	5-yr Survival (%)		
				Average	Highest	Lowest
Any	1	101	13	13	23 (R ₀)	0 (R ₂)
Carina	8	327	18	26	42	13
Left atrium	5	85	8	8	22	0
SVC	3	40	8	23	31	15
Vertebral bodies	2	29	0	42	nd	nd
Aorta	2	27	0	nd	nd	nd
Esophagus	1	7	nd	14	nd	nd
Main PA	1	7	nd	0	nd	nd

*nd, no data; PA, pulmonary artery; R₀, complete resection; R₂, incomplete resection with gross residual disease; SVC = superior vena cava.





- **Satellite Nodules**

- Same histology and same lobe as primary lesion

- **Synchronous Second Primary Lung Cancer**

- Different lobe

- Different histological type

- Same histological type; different molecular genetic characteristics, or by clinical different lobe without mediastinal node involvement and no extrapulmonary metastases.

- **Metachronous Second Primary Lung Cancer**

- At least a 4 – year interval

- Different histological type

- Same histology and no evidence of systemic metastases.

- **Metastatic Pulmonary metastases**

- Same histology and multiple systemic metastases

- Same histology in different lobes and presence of N2,3 or 2 year interval.



Satellite Nodules

- Classify as T 4
- Majority (57 – 86 %) of additional nodules are benign
- 5 – year survival in N 0 is 64 % (54-70 %)
- Deslauriers 1989 reported 1,3, and 5 yr survival 61%, 33%, 22% while single lesion 78%, 54%, 44%.
-



Synchronous Second Primary Lesion

- Incidence 0.26- 1.33%
- 1/3 of the second foci are found incidentally during operation
- 60 % same histological type
- 60 % Squamous Cell
- Survival is worse, stage for stage than single lesion.



Diagnostic possibility for Synchronous Pulmonary tumors

- Synchronous primary carcinoma of lung
- One primary carcinoma, one metastases – Satellite lesion
- Two metastases from extrathoracic cancer
- One primary lung cancer, one benign
- Both benign lesions



Metachronous Second Primary Lung Cancer

- Incidence 0.5% of all lung cancer patients
- 10 – 32% of long term survivors of lung cancer
- Some doctors have included patients > 2 year interval (1)
- 1/3 patients are candidates for surgery
- 2/3 patients inadequate pulmonary reserve
- Higher morbidity and mortality
- 5 – year survival rate 20- 30 %

Martini N Thorac Cardiovasc Surg 1975;70:606-612



Synchronous solitary brain metastases and lung cancer

- Lung cancer is the most common metastasizes to brain
- 40 % lung cancer develop brain metastases
- 1 % patients are synchronous presentation
- Resent retrospective report compared surgery both, lung resection and brain radiation, and only brain surgery and found median survival 331,151, and 92 days respectively.

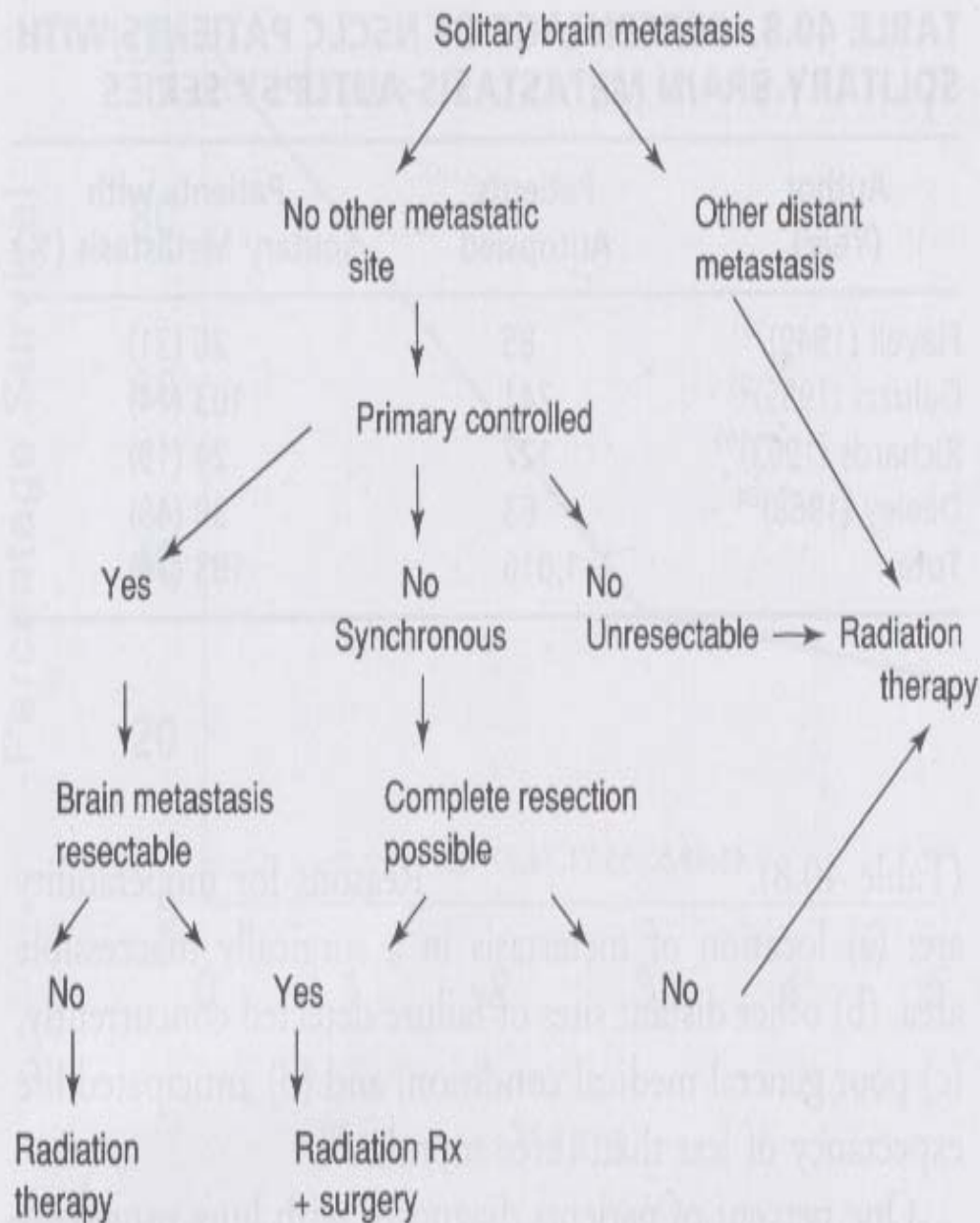


FIGURE 40.8. Algorithm for management of solitary brain metastasis.



Maria Sharapova



However

- Relapse at primary site 20 -25 %
- Toronto group (1983) reported 6 % recurrent rate in patients who underwent surgery after induction chemotherapy.
- 5 – 10 % SCLC combine with other lung cancer histologies especially peripheral lesion.



Role of surgery in SCLC

- All limited SCLC patients with T 1-2 N 0
- Stage 2 SCLC that response to initial chemotherapy
- Little role for patients stage 3 tumor even in well response to chemotherapy.
- Combined SCLC and NSCLC.

Waddell TK Thorax Surg Clin 2004; 14(2): 271-281

Small Cell Lung Cancer (SCLC)

- 20 – 25 % of all primary lung cancer
- < 5 % in surgical series
- Prospective studies ^(1,2) found radiotherapy was preferable to surgery
- SCLC is a highly chemosensitive tumor response rates of 80%
- The standard treatment for limited SCLC consists of chemotherapy and thoracic irradiation and/or prophylactic cranial irradiation.

1.The Medical Research Council of Great Britain.Lancet 1966;2;979.

2.Fox W.Lancet 1973;2:63



Conclusion

In advance stage of Lung Cancer, role of surgery still exist but we are not a hero any more. We are part of the team.

Although the result of any treatment in advance stage of Lung Cancer is not as good as early stage, combination of treatments improve survival and quality of patients' life.



THANK YOU

