



Sublobar resection for early-stage lung cancer

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APPLICANT CITY



IASLC
18th World Conference
on Lung Cancer
2017, Yokohama, Japan



Sublobar resection for early-stage lung cancer

Disclosures:

Lecture fee from (greater than 5,000 USD)

- 1. Johnson and Johnson, Co.**
- 2. Covidien Japan, Co.**

Evolution of Lung Cancer Surgery

No Surgical Indication



Pneumonectomy

30 Years



Lobectomy



Lung Cancer Study Group (**Ginsberg** RJ). Randomized trial of lobectomy versus limited resection for T1N0 non-small cell lung cancer. (1995)

- **Nissen**: First successful left-sided pneumonectomy as a two-stage procedure (1930)
- **Graham** and Singer: First successful en bloc left pneumonectomy for lung cancer (1933)
- **Overholt**: First successful en bloc right pneumonectomy for carcinoid tumor (1935)

Cahan W. "Radical lobectomy" (1962)

30 Years

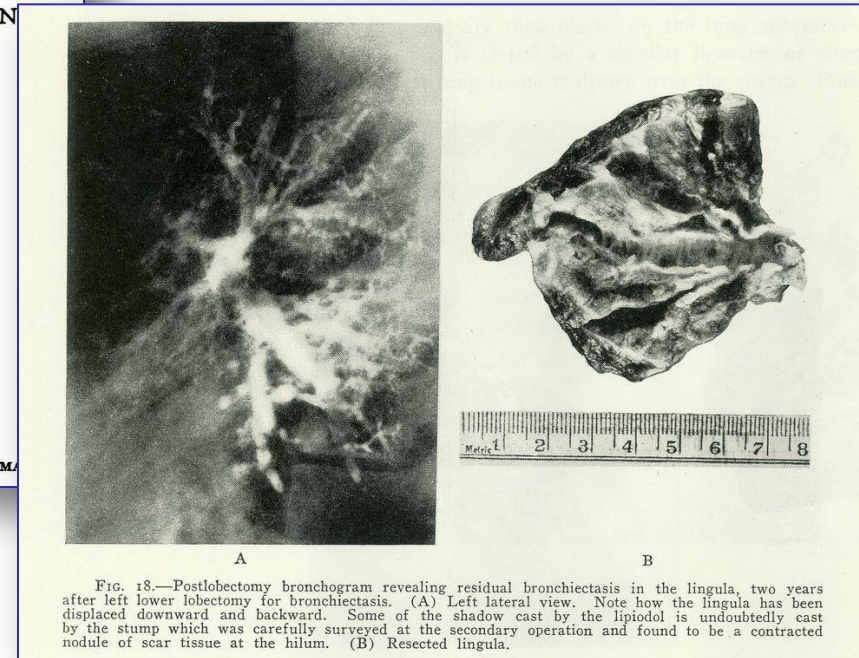
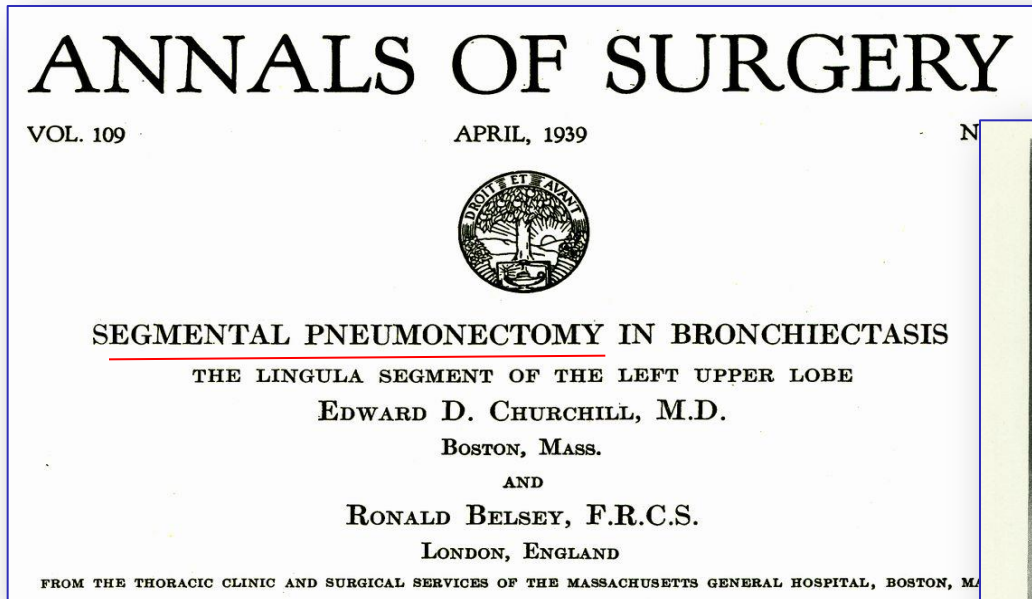


Limited resection



Evarts A. Graham

History of Segmentectomy: “Segmental pneumonectomy” by Churchill



Churchill ED and Belsey R.
Ann Surg 1939;109: 481-499

A report on 86 patients who underwent lingular segmentectomy for bronchiectasis at MGH.

History of Segmentectomy: Segmentectomy for Lung Cancer by Jensik

Segmental resection for lung cancer *A fifteen-year experience*

*Robert J. Jensik, M.D., L. Penfield Faber, M.D., Frank J. Milloy, M.D.
(by invitation), and David O. Monson, M.D. (by invitation), Chicago, Ill.*

Jensik RJ. *J Thorac Cardiovasc Surg* 1973; 66: 563-572

Results:

5YSR: 56%

Local recurrence rate: 10%

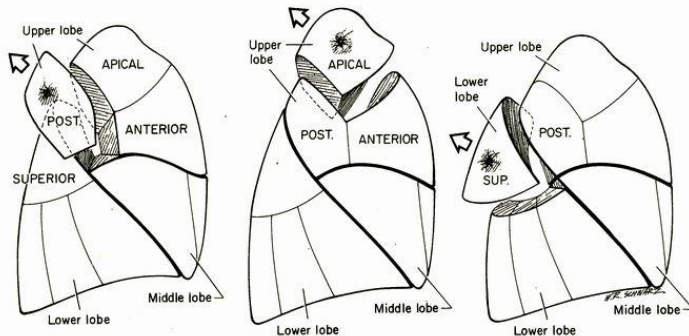


Fig. 1. Segmental resections in right lung. Upper lobe: posterior and apical. Lower lobe: superior.

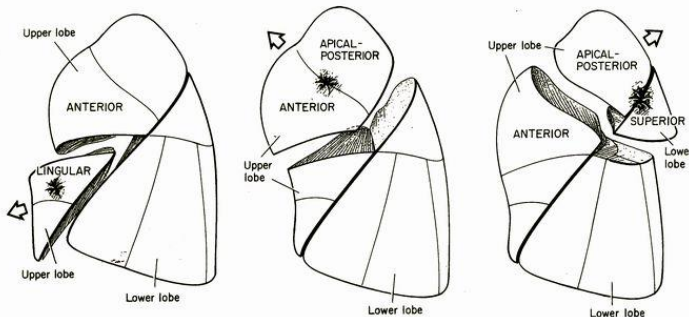


Fig. 2. Segmental resections in left lung. Upper lobe: Lingula and superior division. Combined apical posterior, left upper and superior, and left lower lobe.

Evolution of Lung Cancer Surgery

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30 Years



Lobectomy



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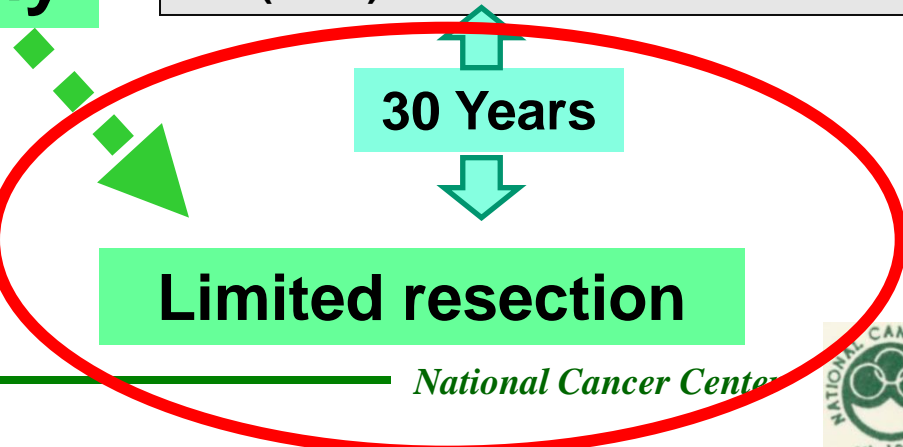
Cahan W. "Radical lobectomy"
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Lung Cancer Study Group
(**Ginsberg** RJ). Randomized trial of
lobectomy versus limited resection
for T1N0 non-small cell lung cancer.
(1995)

30 Years



Limited resection



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Evarts A. Graham



Randomized trial of Lobectomy versus Limited Resection for T1N0 Non-small Cell Lung Cancer

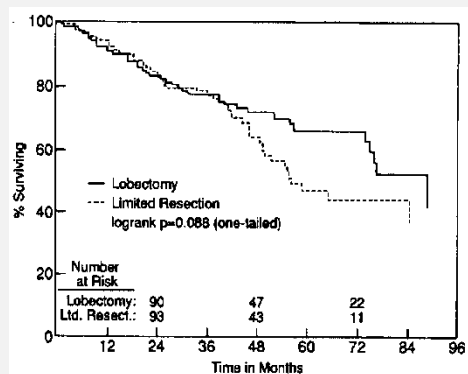
Ginsberg RJ, et al. *Ann Thorac Surg* 1995;60: 615-23

Study cohort: Total 276 pts., 247 pts. eligible for analysis.

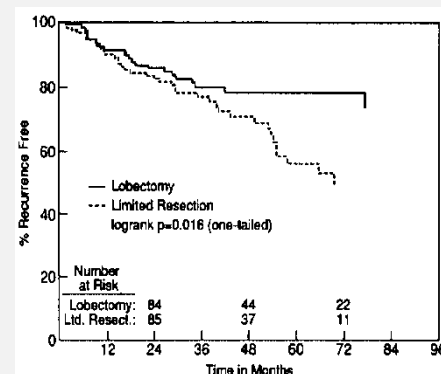
Lob (125), Lim (122, Seg 82, WWR 40)

Results:

- **75% increase in rec rates** ($P=0.02$), 3 fold increase in local rec rate for Lim ($P=0.008$).
- **30% increase in overall death rate** ($P=0.08$), 50% increase in death with cancer rate for Limited.
- Pulmonary function: Follow-up and reporting were judged to **be not totally reliable because funding terminated early**.



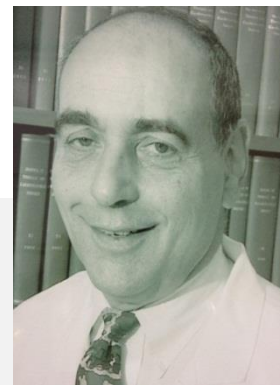
Time to Death ($p=0.088$)



Time to Recurrence ($p=0.016$)

Conclusions:

- (1) Lim does not confer improved perioperative morbidity/mortality/late postoperative pulmonary function.
- (2) Because of the higher death rate and locoregional rec rate associated with Lim, **Lob still must be considered the surgical procedure of choice for pts. with peripheral T1N0 NSCLC.**



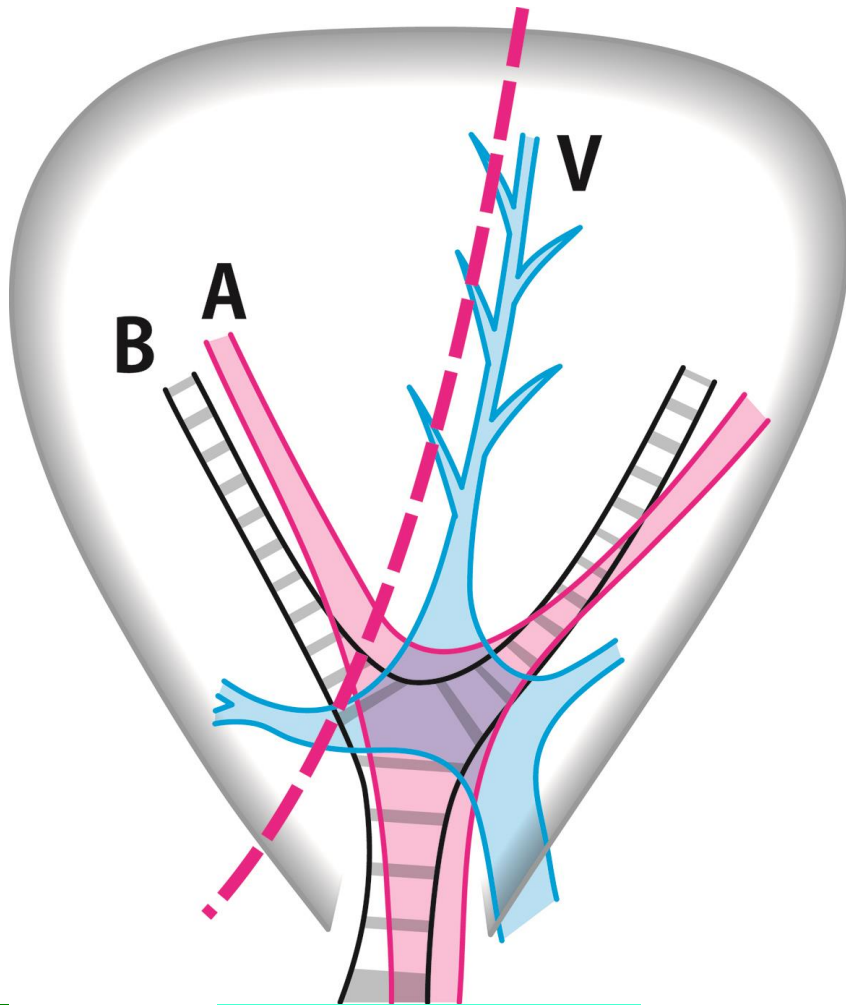
State of the Art **2014**: Surgery



Standard mode of pulmonary resection for lung cancer in 2014

- 1) At least **LOBECTOMY**
+
- 2) Hilar and mediastinal LNS/LND
by Open/VATS approach

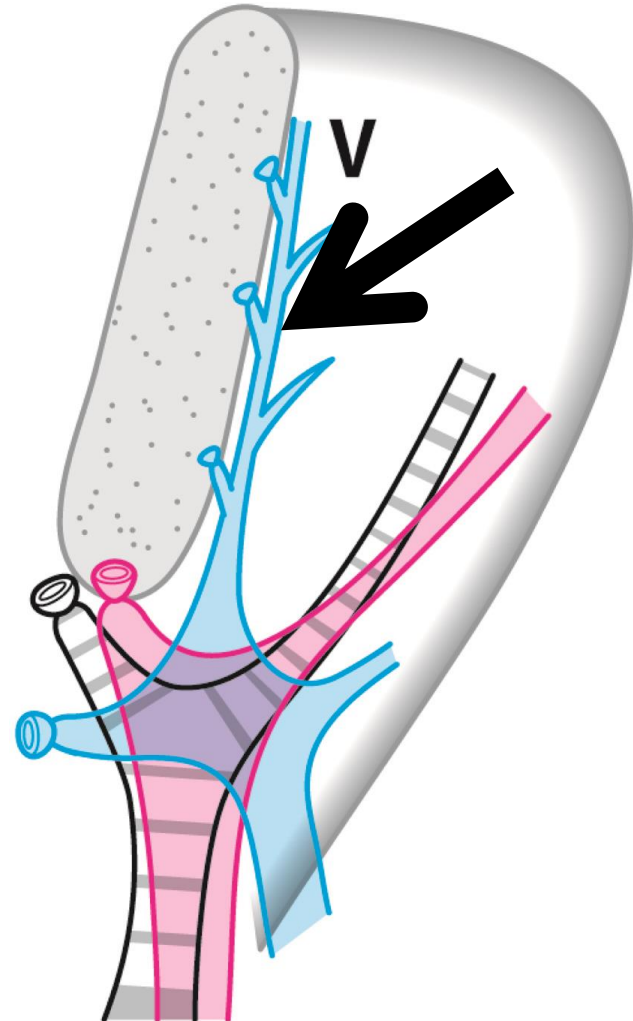
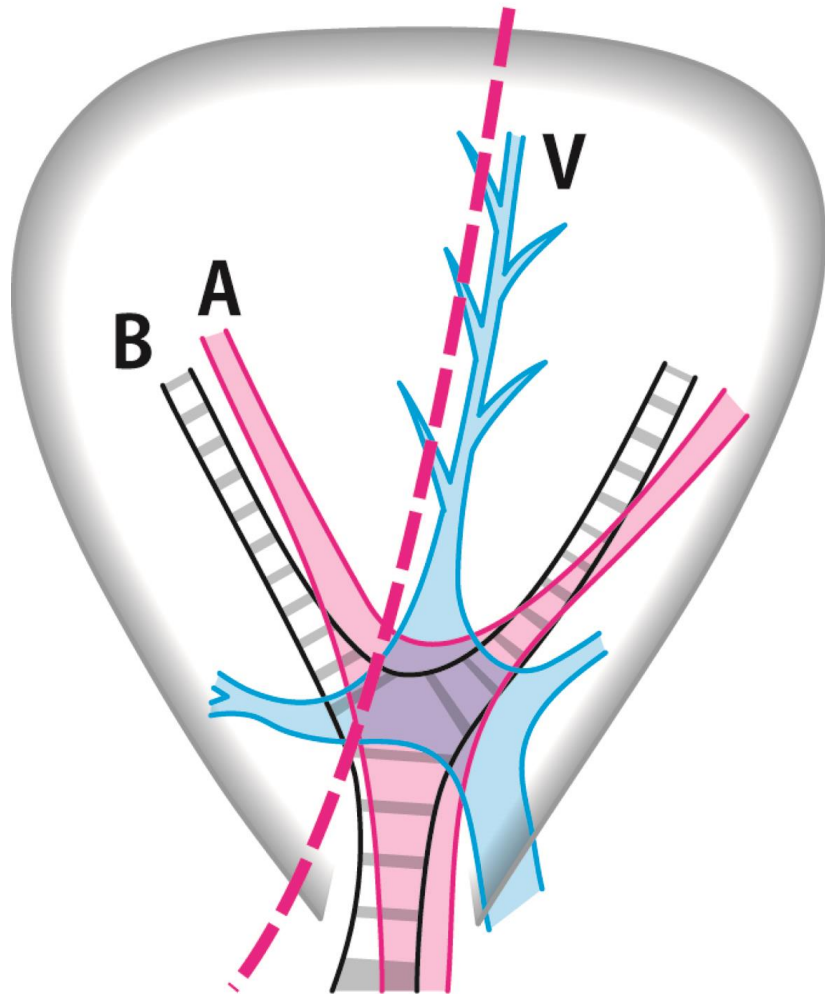
Anatomical Basis of Segmental Resection



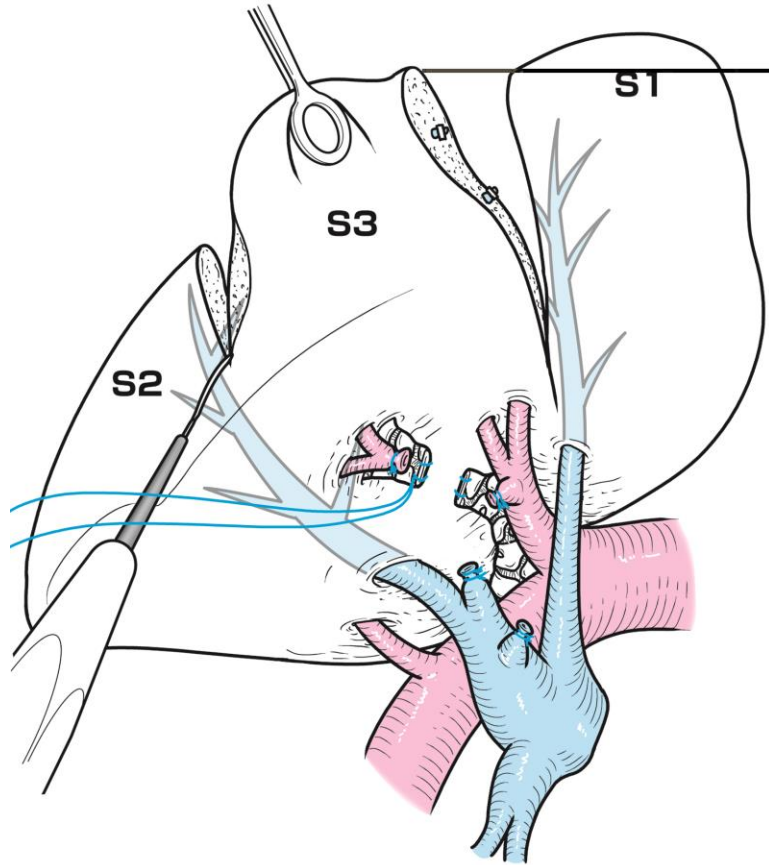
Technique for Segmentectomy:

- Anatomical sublobar resection
- Division of bronchus, pulmonary vessels at the hilum (not periphery)
- Several technical variations

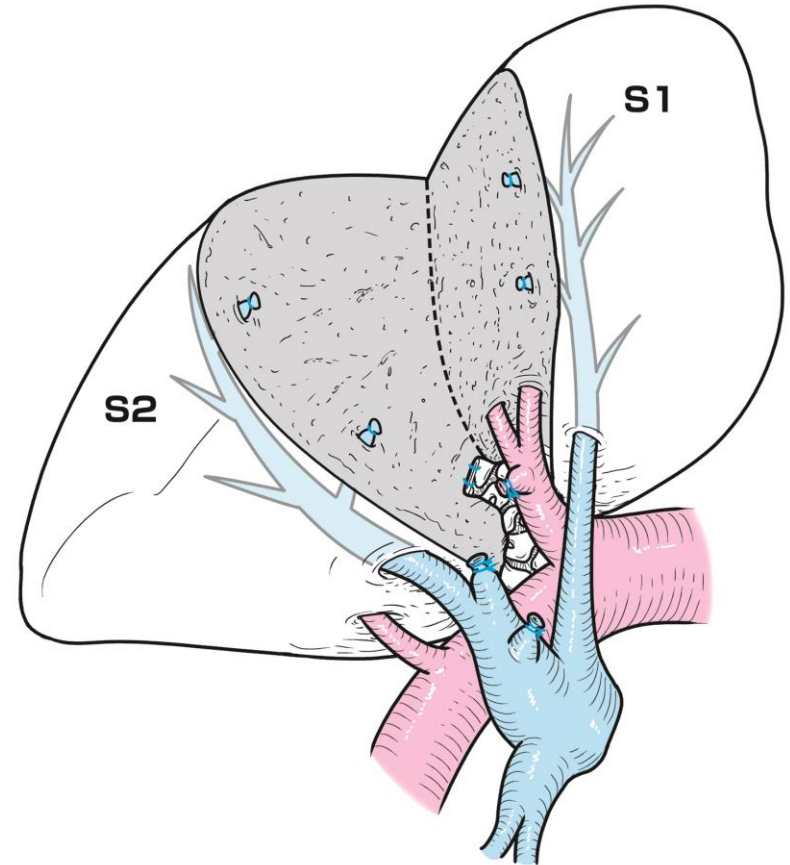
Technical Variations of Segmentectomy: Classic Segmentectomy



Anterior Segmentectomy of the Right Upper Lobe



Division on intersegmental plane



After segmental resection

“Intersegmental Plane”

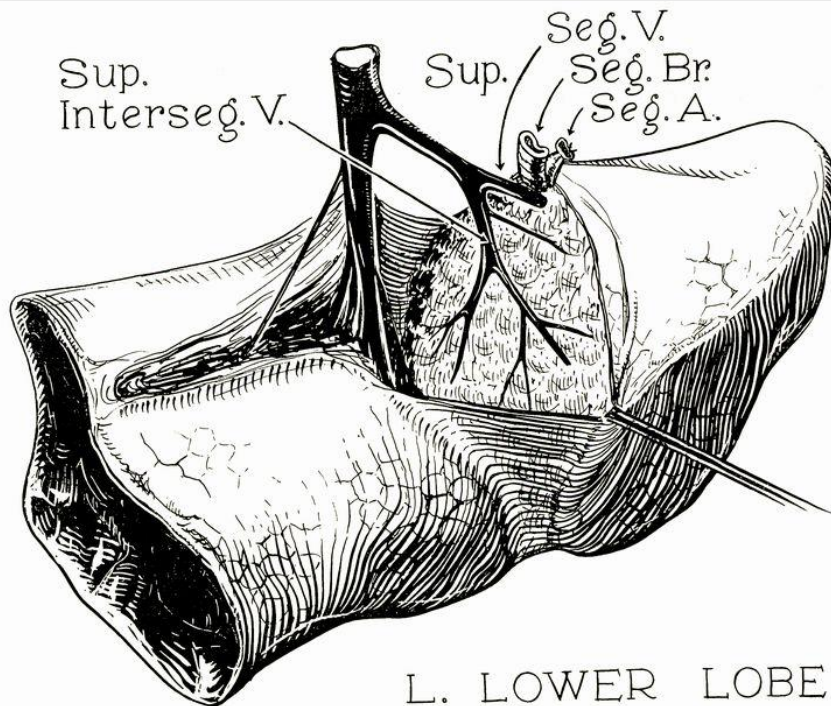


Fig. 3.—This is an anatomic drawing of a dissected specimen illustrating the intersegmental anatomy of a superior segmental resection. The segmental artery and bronchus have been divided. The superior division of the inferior pulmonary vein is shown dividing into a segmental and an intersegmental branch. The intersegmental branch and its tributaries have been followed into the intersegmental plane separating the superior division from the basal segments. Just the pleura remains undivided between the two portions. The vein labeled “Segmental Vein” is the common trunk formed by the branches draining the three subsegments of the superior segment. These branches are both intersegmental and segmental.

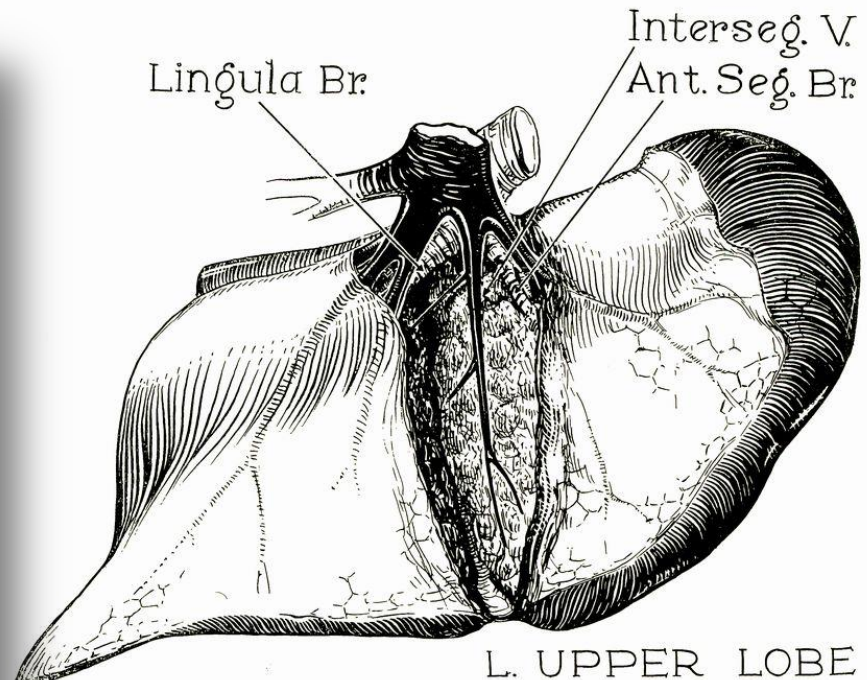
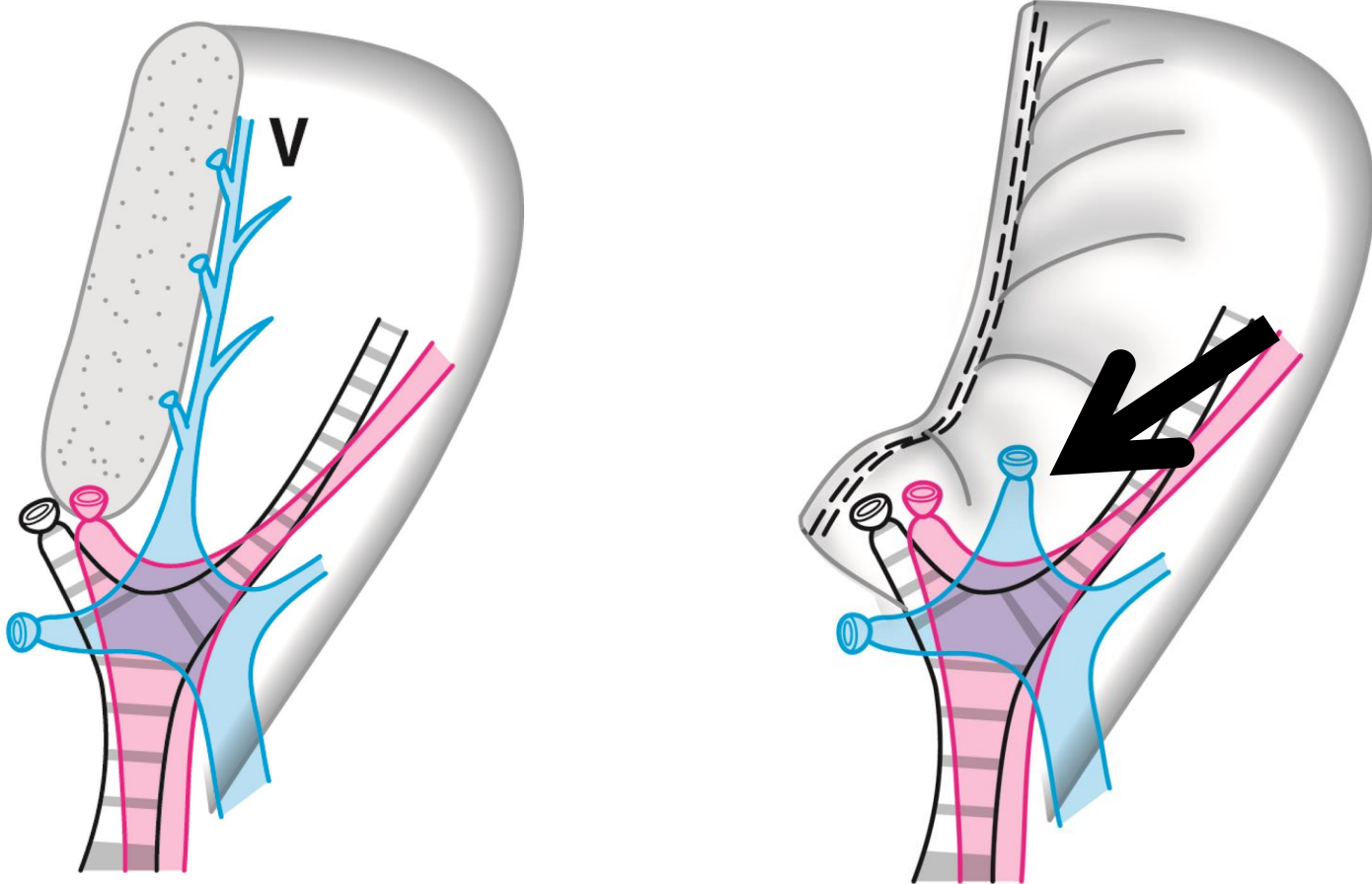


Fig. 4.—This drawing of a dissected specimen demonstrates the intersegmental vein which delineates the plane of dissection between the lingula and the anterior segment. The bronchi of the lingula and of the anterior segment can be seen on either side. Several subpleural veins are illustrated.

Ramsay BH. The anatomic guide to the intersegmental plane. *Surgery* 1948: 533-538

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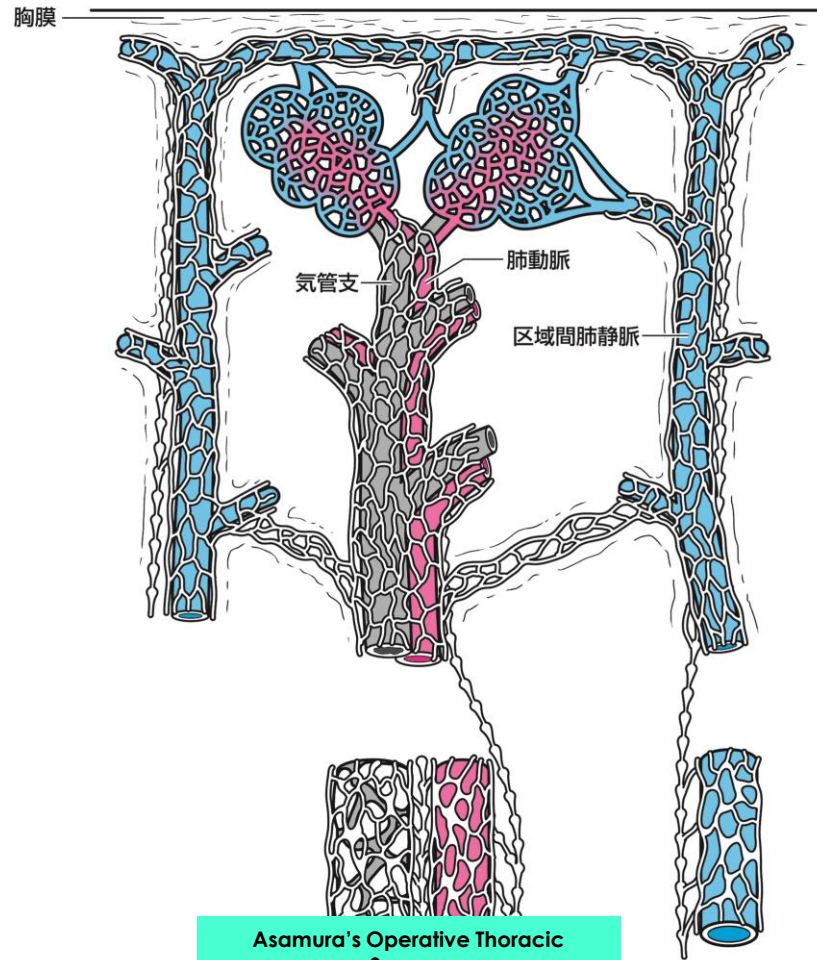
Technical Variations of Segmentectomy: How to deal with intersegmental vein?



Asamura's Operative
Thoracic Surgery

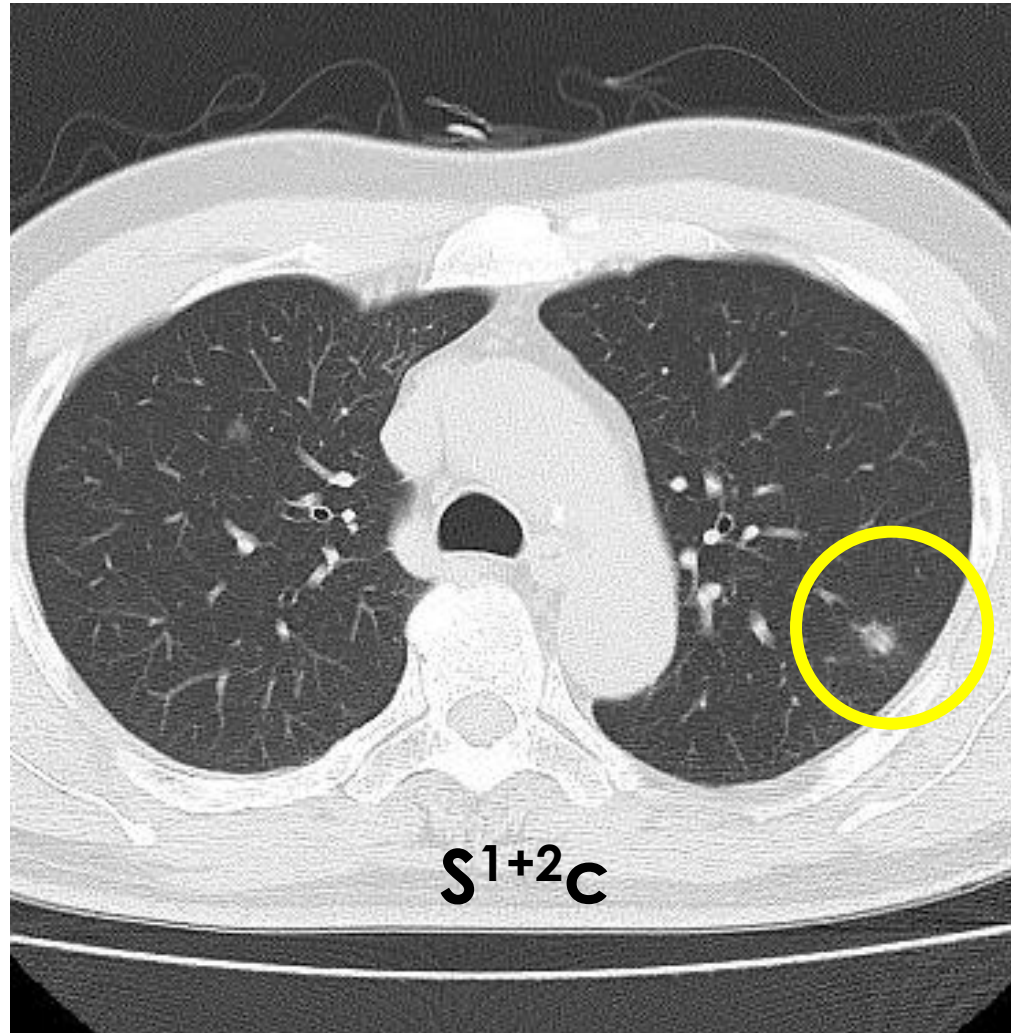
National Cancer Center

How to Deal with Intersegmental Veins?: A Cautious Note on Lymphatics in the Lung



Asamura's Operative Thoracic
Surgery

Worst Scenario after Segmentectomy (First surgery at another hospital)



Pathology at Initial Surgery

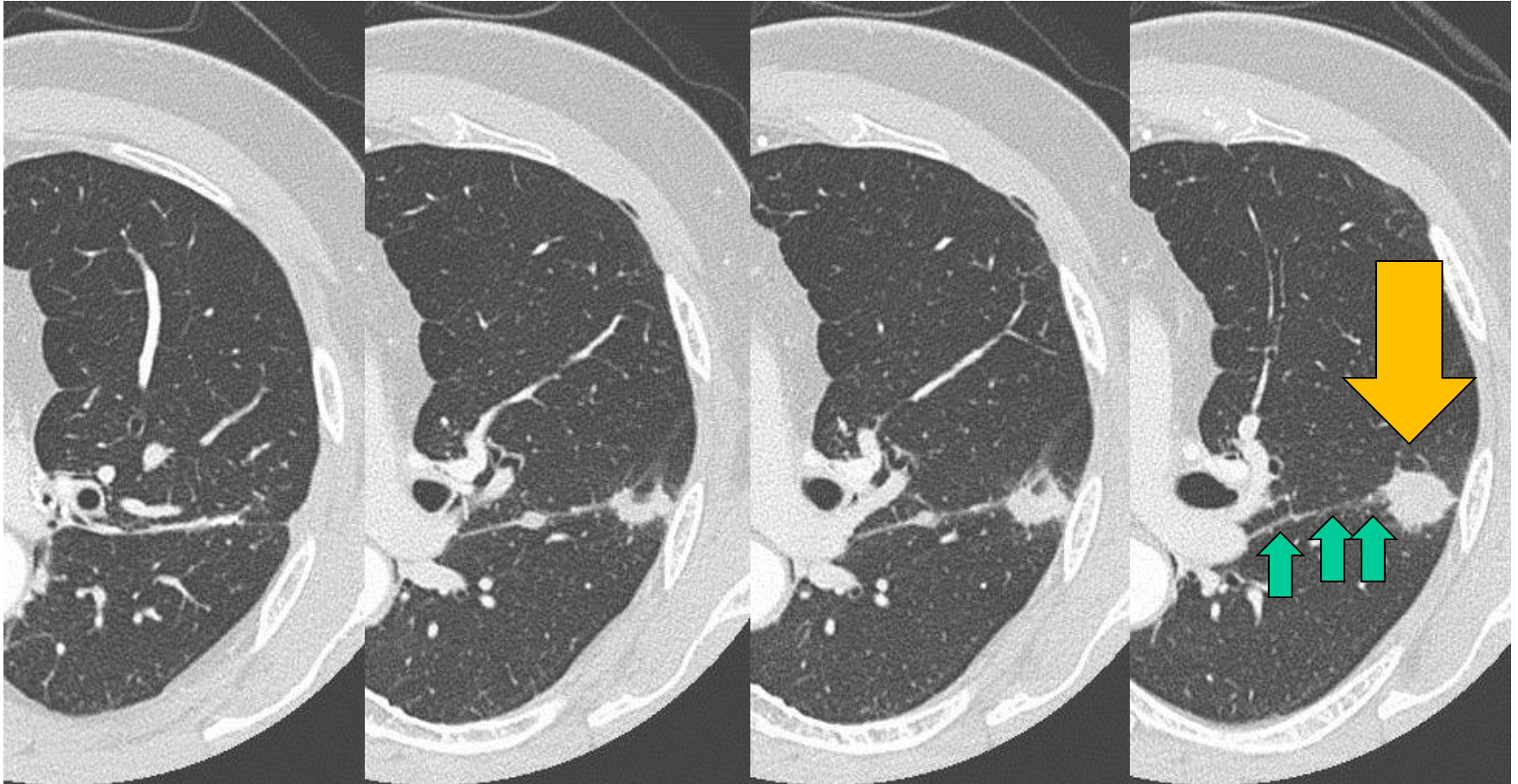
Micropapillary pattern

Surge
Patho

my

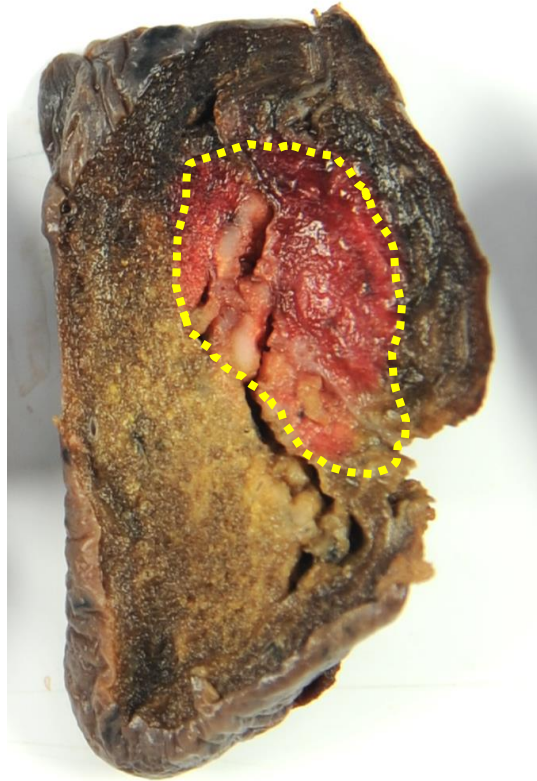
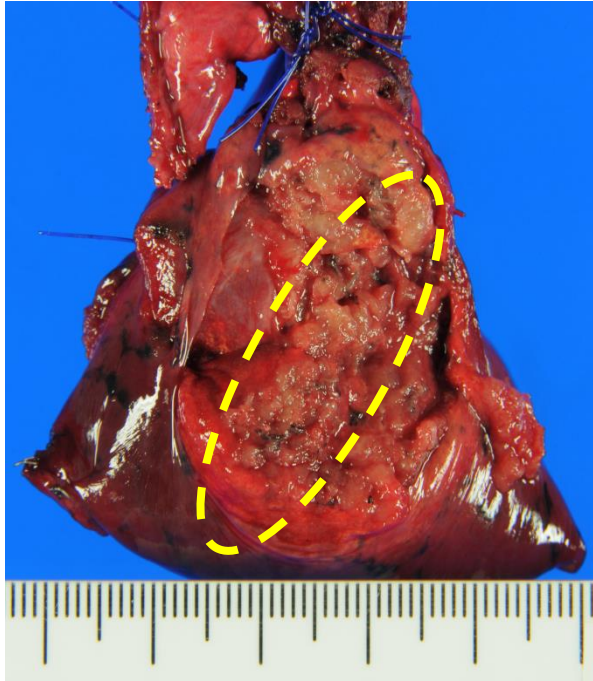
no description of residual margin

CT Findings 43 Months after Surgery



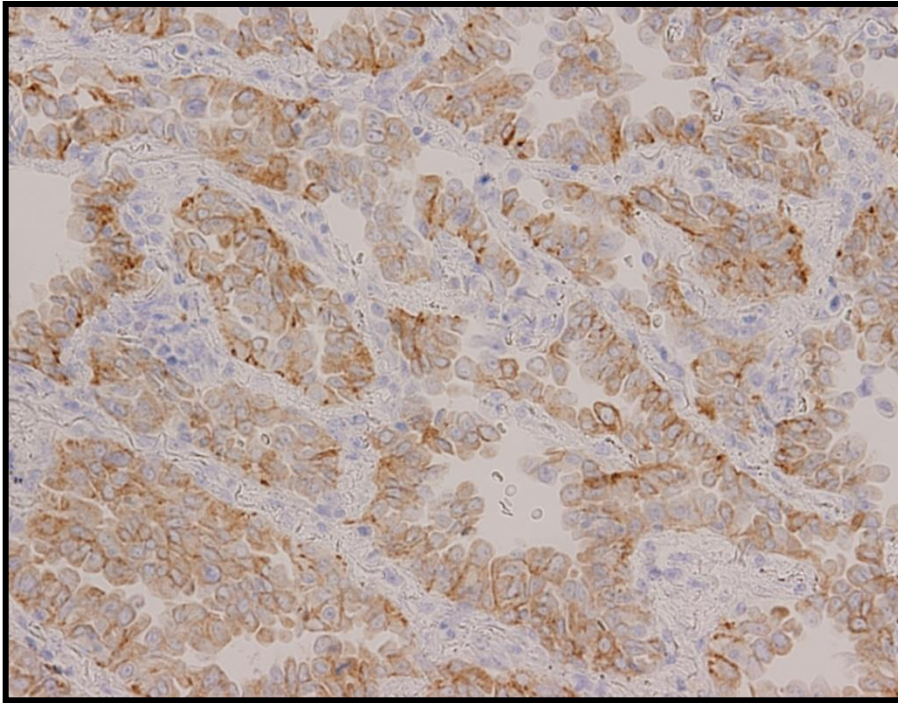
A new nodule on the staple line

Completion Pneumnectomy

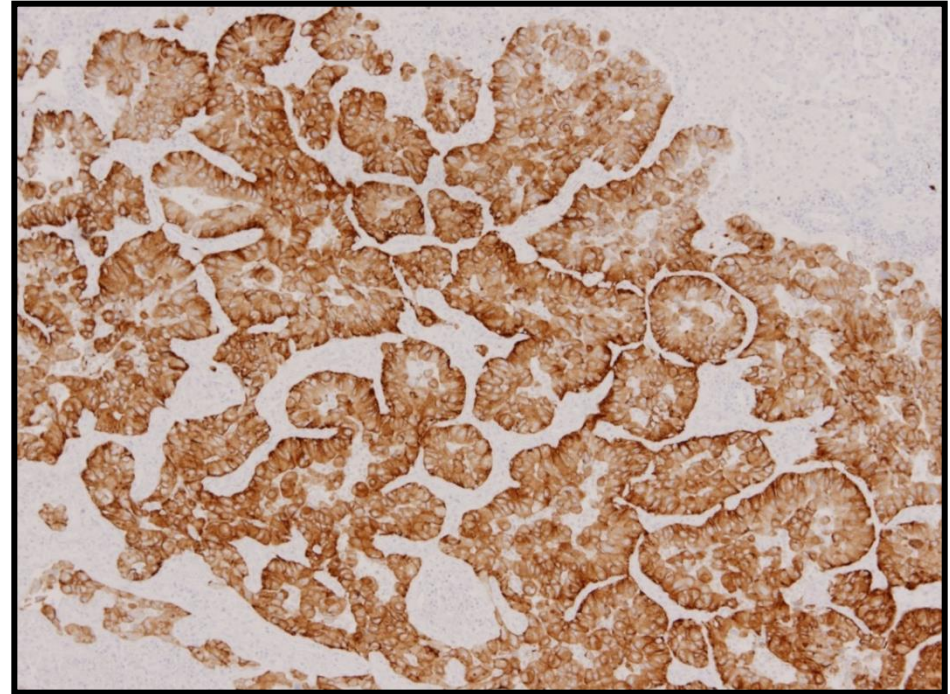


Tumor included surgical staples in the center.

Immunohistochemical Study



At initial surgery



At second surgery

EGFR L858R-positive

Summary of This Case

- ✚ Segmentectomy performed at previous hospital was **technically inappropriate**, leaving cancer cells behind (incomplete segmentectomy) probably on the staple lines.
- ✚ **Penny wise and pound foolish,** tight adhesion at the interlobar fissure around pulmonary artery.
- ✚ This patient would not have had tumor recurrence, if he had had **lobectomy** at the first operation.

Worst Scenario

**More segmentectomies,
more recurrences.**

Pro and Con for Lob & Sub-Lob Resection for T1N0 NCLC

Table 6. Summary of Studies Comparing Sublobar With Lobar Resection for Stage I Non-Small Cell Lung Cancer

Study	Sublobar Resection			Lobar Resection		
	N	5-year Survival (%)	Local Recurrence (%)	N	5-year Survival (%)	Local Recurrence (%)
<u>Pro lobar resection</u>						
LCSG [15]	122	44	17.2 ^a	125	65 ^a	6.4
Warren [22]	66	43	22.7 ^a	103	67 ^a	4.9
Miller [23]	25	33	7	75	71 ^a	11
Martini [24]	62	59	50 ^a	511	77 ^a	24
<u>Pro sublobar resection</u>						
Errett [25]	100	69	NA	97	75	NA
Pastorino [26]	61	55	36	411	49	38
Read [27]	113	84	4.4	131	74	11.5
Landreneau [28]	102	62	19 ^a	117	70	9
Okada [17]	130	91	NA	132	78	NA
Kodama [29]	46	93	2.2	77	88	1.3
Koike [30]	74	89	2.7	159	90	1.3

^a Statistically significant.

LCSG = Lung Cancer Study Group; NA = not available.

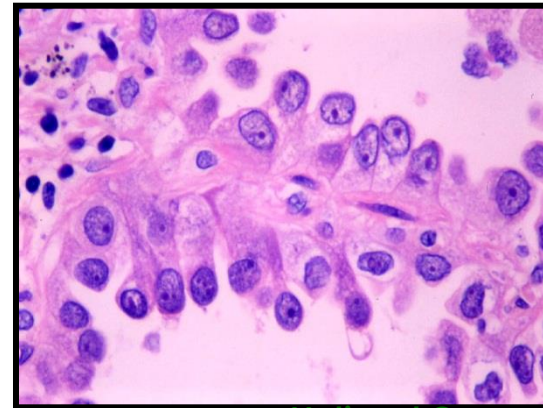
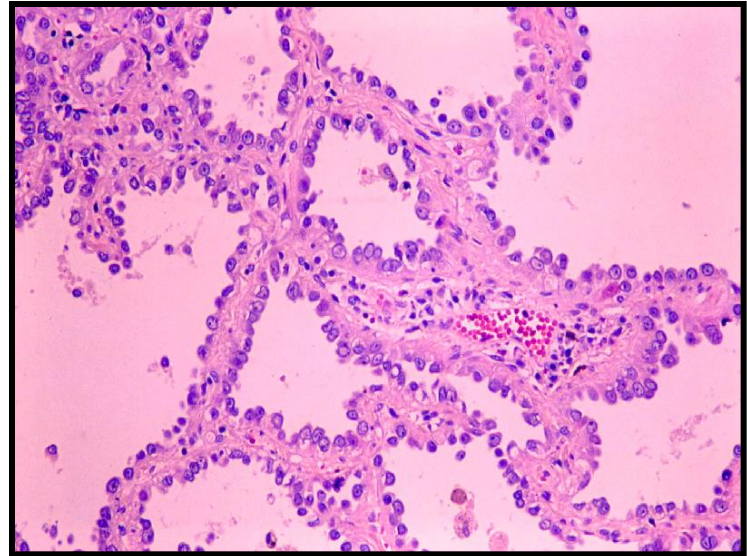
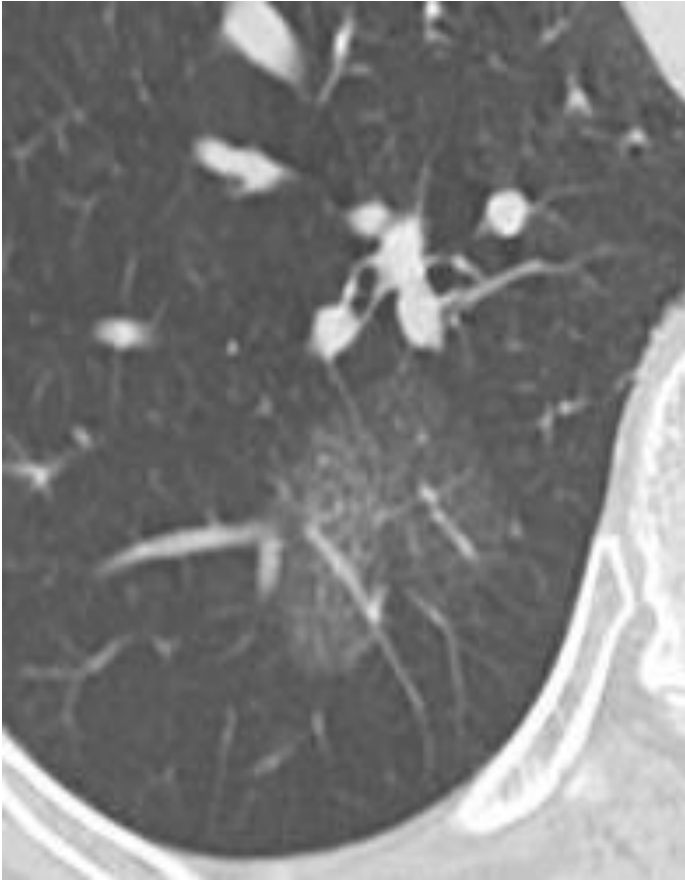
El-Sherif et al. Ann Thorac Surg 2006; 82: 408-16

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Indication of Segmentectomy?

GGO: a CT Form of Early Peripheral Cancer



Radiographically determined noninvasive adenocarcinoma of the lung: Survival outcomes of Japan Clinical Oncology Group 0201

Hisao Asamura, MD,^a Tomoyuki Hishida, MD,^b Kenji Suzuki, MD,^c Teruaki Koike, MD,^d Kenichi Nakamura, MD,^e Masahiko Kusumoto, MD,^a Kanji Nagai, MD,^b Hirohito Tada, MD,^f Tetsuya Mitsudomi, MD,^g Masahiro Tsuboi, MD,^h Taro Shibata, MSc,^e and Haruhiko Fukuda, MD,^e on behalf of the Japan Clinical Oncology Group Lung Cancer Surgical Study Group

Asamura H et al. J Thorac Cardiovasc Surg 2013;146:24-30.

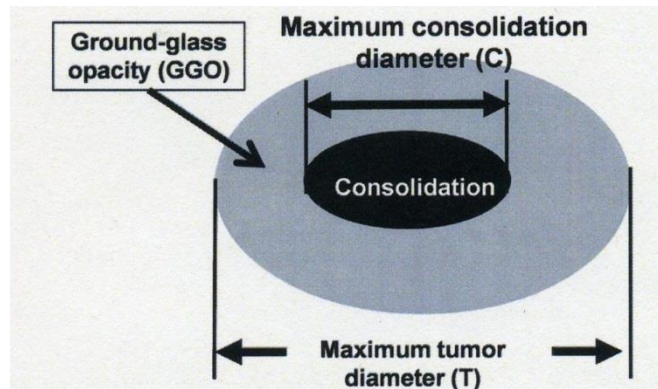
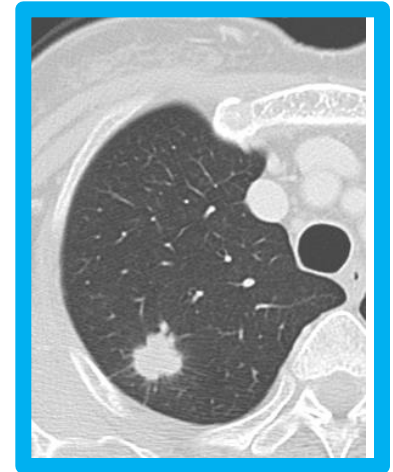
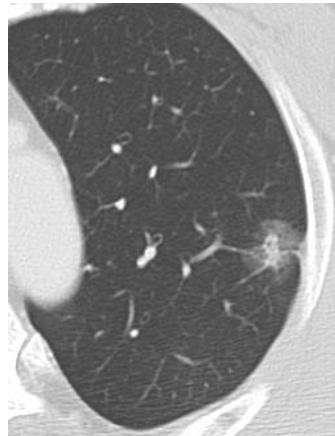
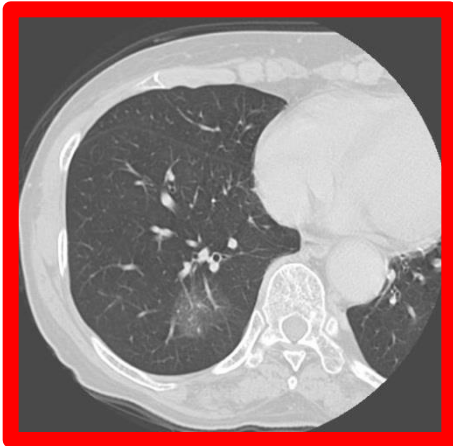


FIGURE 1. Calculation of the C/T ratio to define radiologic noninvasive lung cancer on TSCT. The maximum diameter of consolidation (C) is divided by the maximum tumor diameter (T) to give the C/T ratio. GGO, Ground-glass opacity; C/T, consolidation/tumor; TSCT, thin-section computed tomography.

$$CTR = C/T$$

Radiological noninvasive cancer:

- T1a (<2.0 cm)
- CTR<0.25

Asamura H et al. J Thorac Cardiovasc Surg 2013;146:24-30.

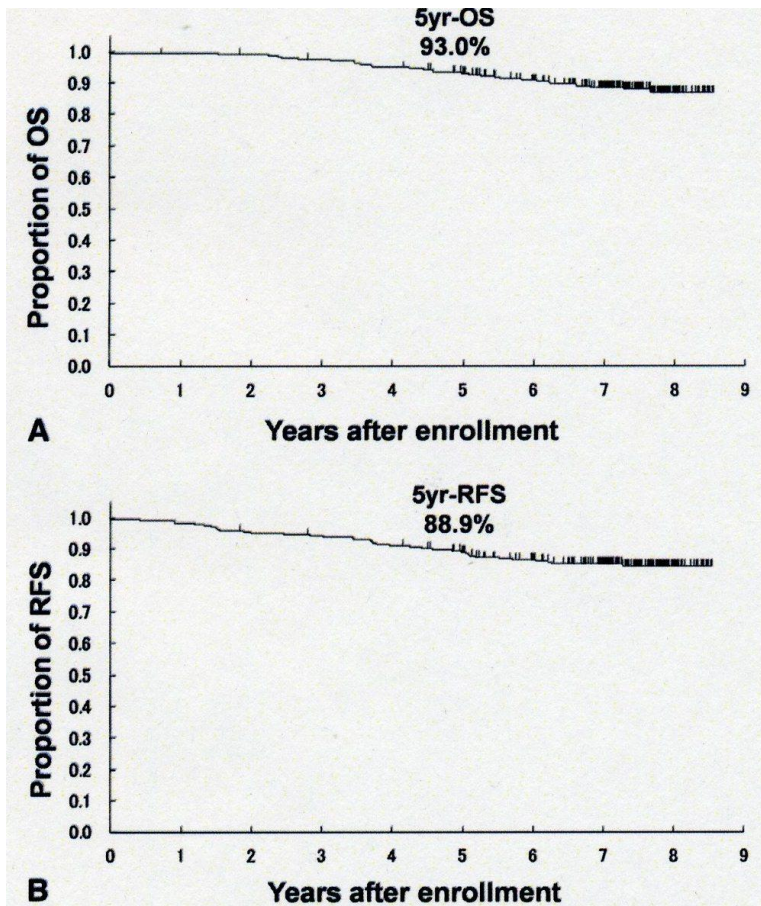


FIGURE 4. Overall (A) and relapse-free (B) survival curves for the cT1a (<2.0 cm) group (n = 289). OS, Overall survival; RFS, relapse-free survival.

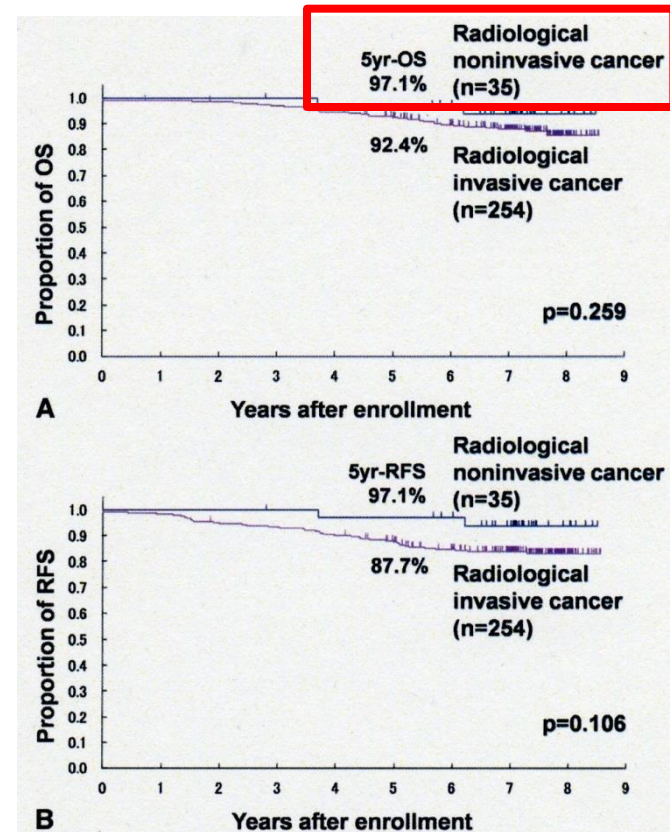


FIGURE 5. Overall (A) and relapse-free (B) survival curves for radiologically noninvasive (n = 35) and invasive (n = 254) adenocarcinomas based on a C/T ratio of 0.25 or less in cT1a (<2.0 cm) for noninvasiveness on TSCT. The differences in overall and relapse-free survival are not statistically significant ($P = .259$ and $.106$, respectively). OS, Overall survival; RFS, relapse-free survival; C/T, consolidation/tumor; TSCT, thin-section computed tomography.

No Surgical Indication



Pneumonectomy

30 Years

Lobectomy

Lung Cancer Study Group (**Ginsberg** RJ).
Randomized trial of lobectomy versus limited
resection for T1N0 non-small cell lung cancer.
(1995)

30 Years

Limited resection

Evolution of Lung Cancer Surgery: A Reevaluation

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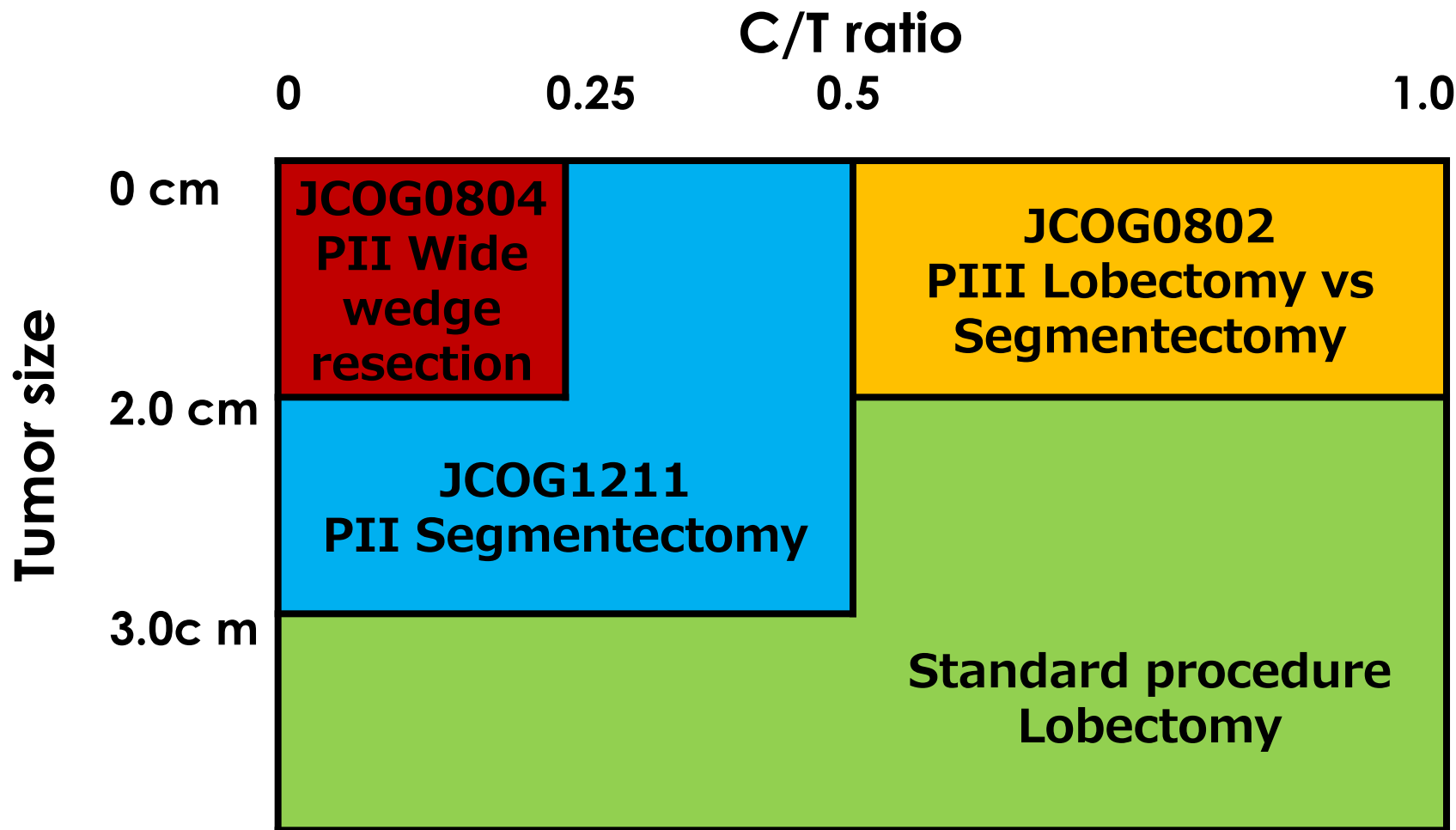
30 Years

Limited resection

JCOG trial
CALGB trial

National Cancer Center





JCOG0802/WJOG4607: Phase III Randomized Trial between Lobectomy and Limited Resection for Small-sized carcinoma (Part-solid GGO – Solid 2cm or Less)



Non-inferiority design

PI: Asamura H.

Peripheral carcinoma, ≤ 2 cm
Negative hilar node

Randomize

Lobectomy

Segmentectomy

Stratified factors:

- Institute
- Gender
- Histology (Ad vs. Non-ad)
- Solid or non-solid

Endpoints:

Primary: **OS**

Secondary: **pulmonary function**

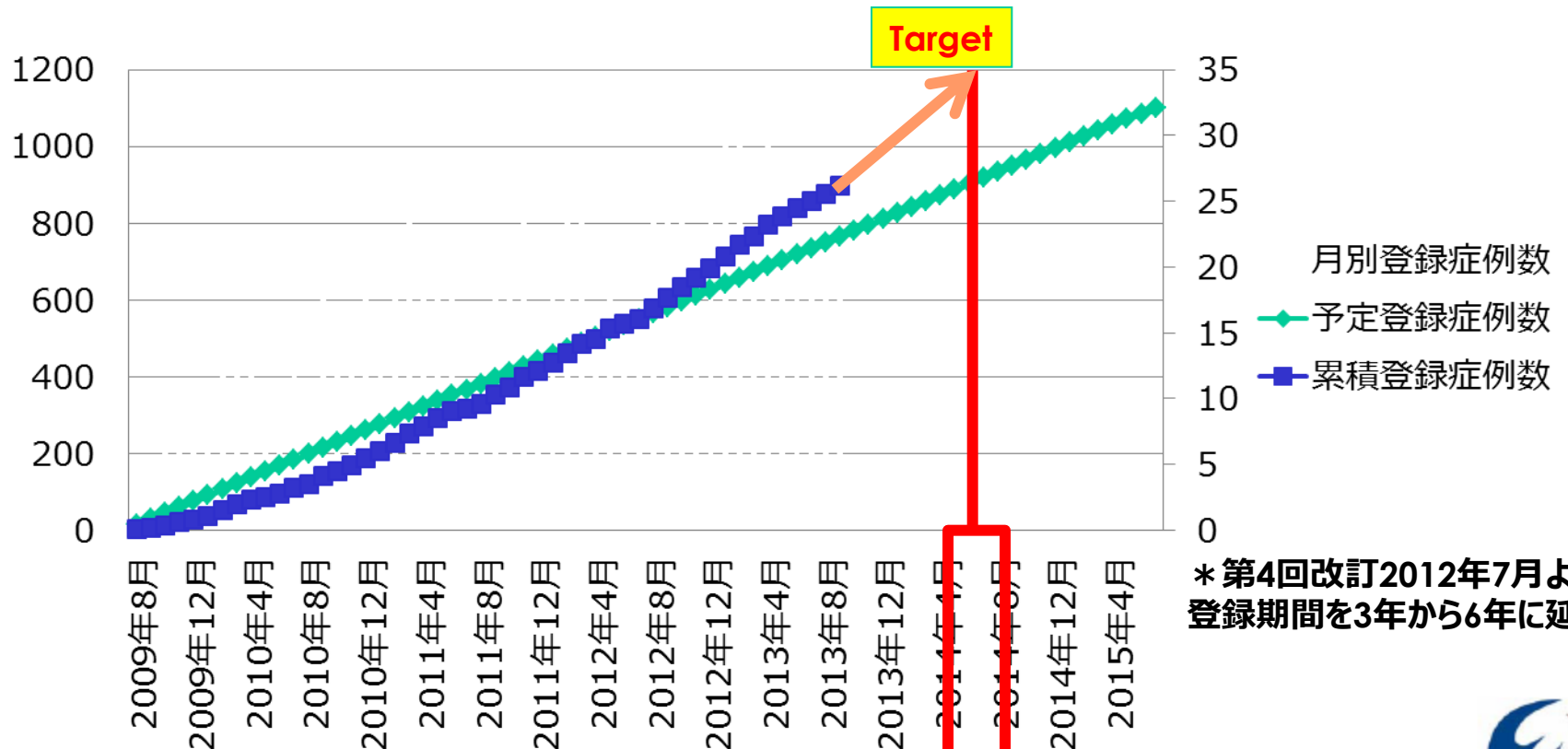
Sample size: **1,100**

JCOG0802/WJOG4607: Phase III Randomized Trial between Lobectomy and Limited Resection for Small-sized carcinoma (Part-solid GGO – Solid 2cm or Less)

As of 2014. March., Total accrual: **995** patients

Target accrual: **1,100** patients

Target closure: **2014. July?**



*第4回改訂2012年7月より登録期間を3年から6年に延長。

JCOG0804/WJOG4507L; Phase II Trial of Limited Resection (Wide wedge resection) for Possible Early Adenocarcinomas (GGO – Part-solid GGO) ; (Single-arm study)

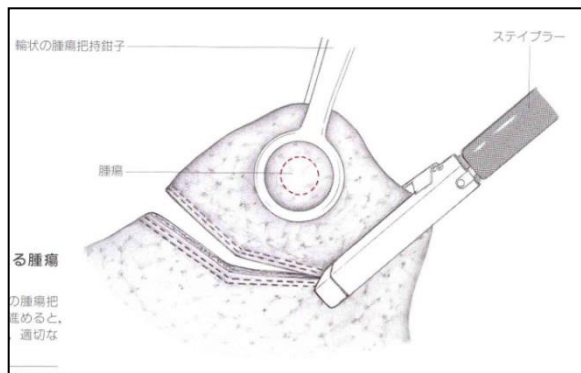
Peripheral carcinoma, ≤ 2 cm
Negative hilar node
C/T ratio ≤ 0.25



Wedge resection

OR

Segmentectomy



JCOG
Japan Clinical Oncology Group

Endpoints:

- **Recurrence-free survival rate at any site**

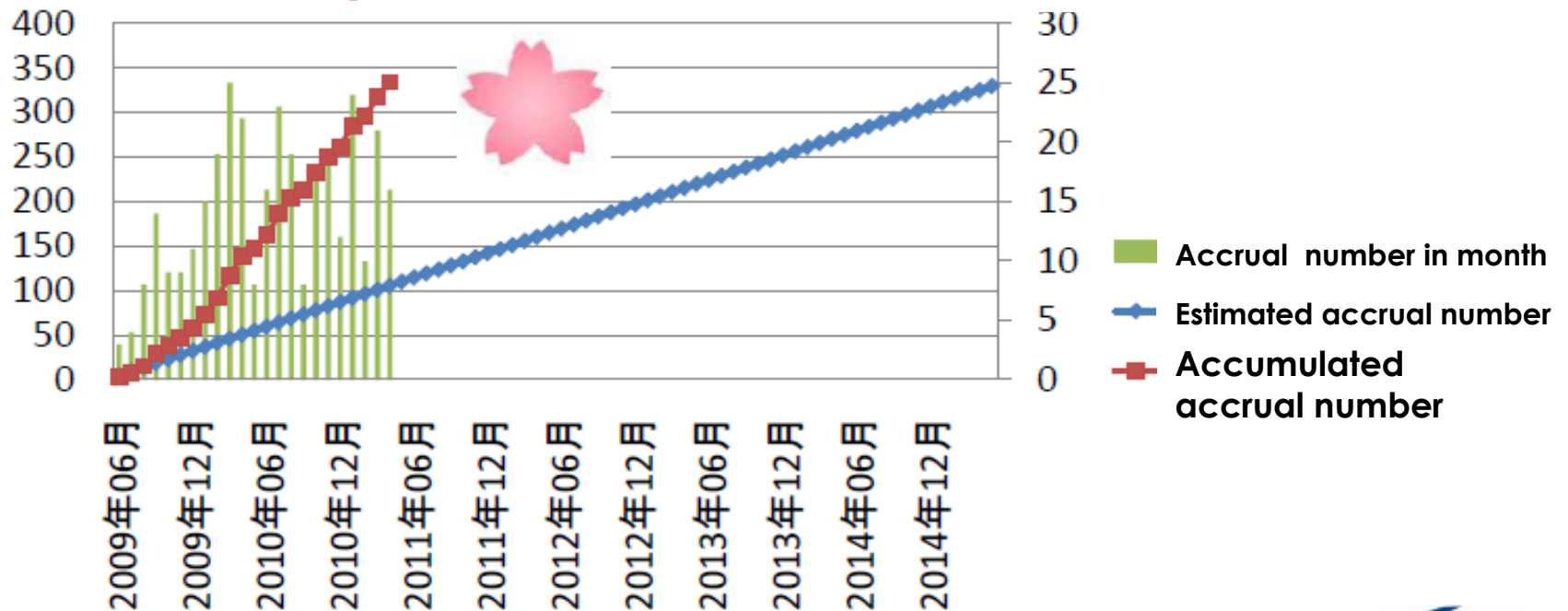
Sample size: **330**

National Cancer Center



JCOG0804/WJOG4507L (early NSCLC LR P2)

**Final enrollment: 334 cases in
April, 2011**

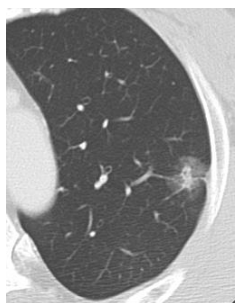
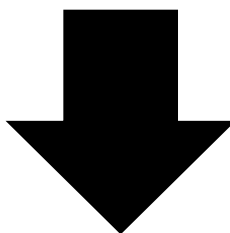


A JCOG Strategy for Small Lung Cancers

JCOG0102



Radiological study to define
noninvasive adenocarcinoma on TSCT



JCOG0804

$T \leq 2\text{cm}$



One-arm, WWW/Seg
(phase II)

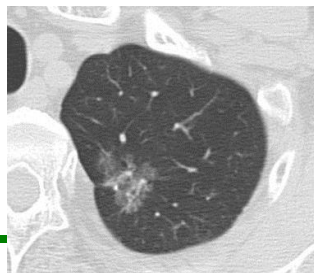


JCOG0802

$T \leq 2\text{cm}$



Lob vs. Seg (phase III)



JCOG1211

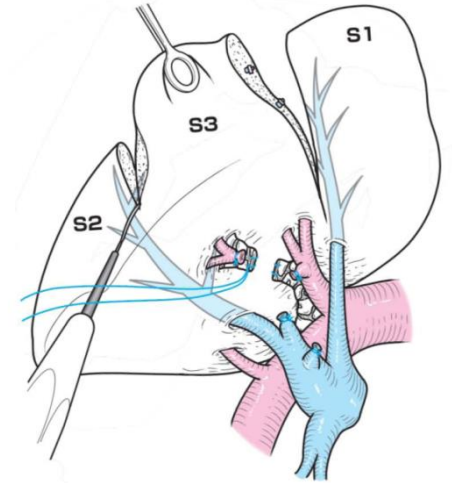
$2 < T \leq 3\text{cm}$



One-arm, Seg (phase II)

Summary So Far about Sublobar Resection

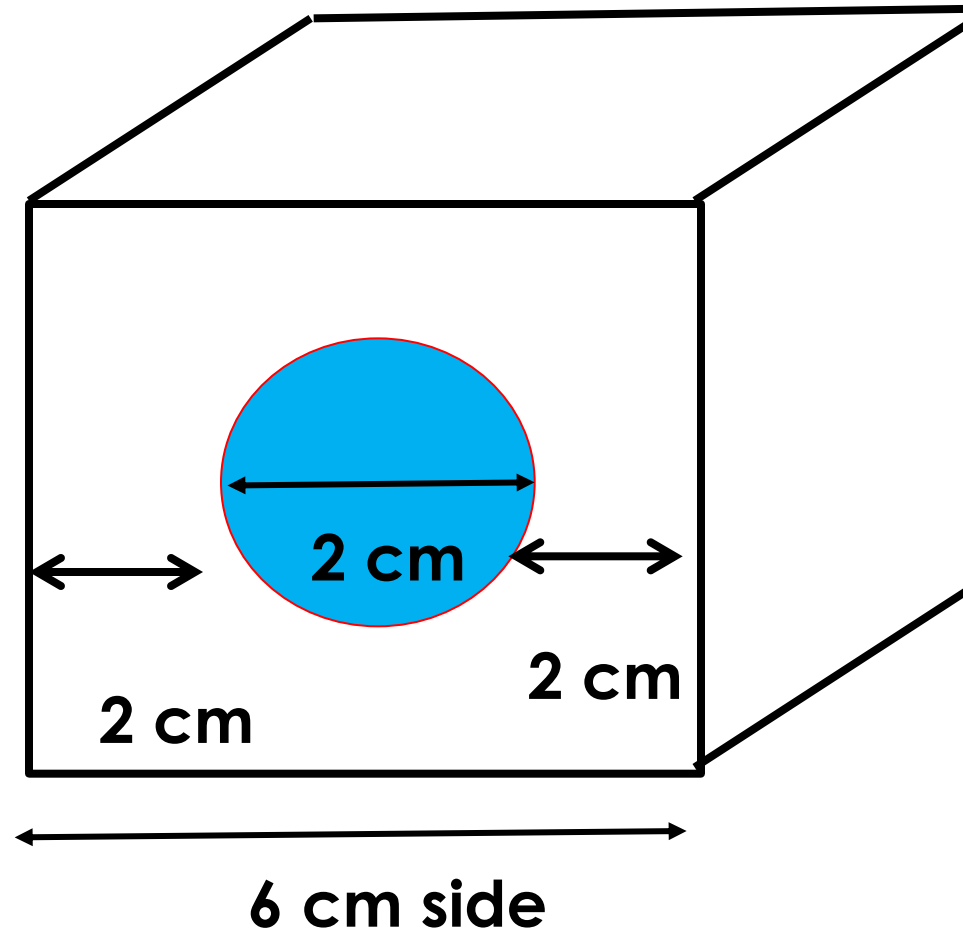
1. Use of sublobar resection should be scientifically evaluated in terms of:
 - **Prognostic equivalence**
 - **Functional advantage**
 - Perioperative outcome.
2. Until the final results of on-going prospective trials become available, we should remain **prudent to do sublobar resection** as a radical procedure for lung cancer.
2. Reasonable indication as of now is that for early, peripheral adenocarcinoma termed as **GGO-AIS/MIA tumors**.



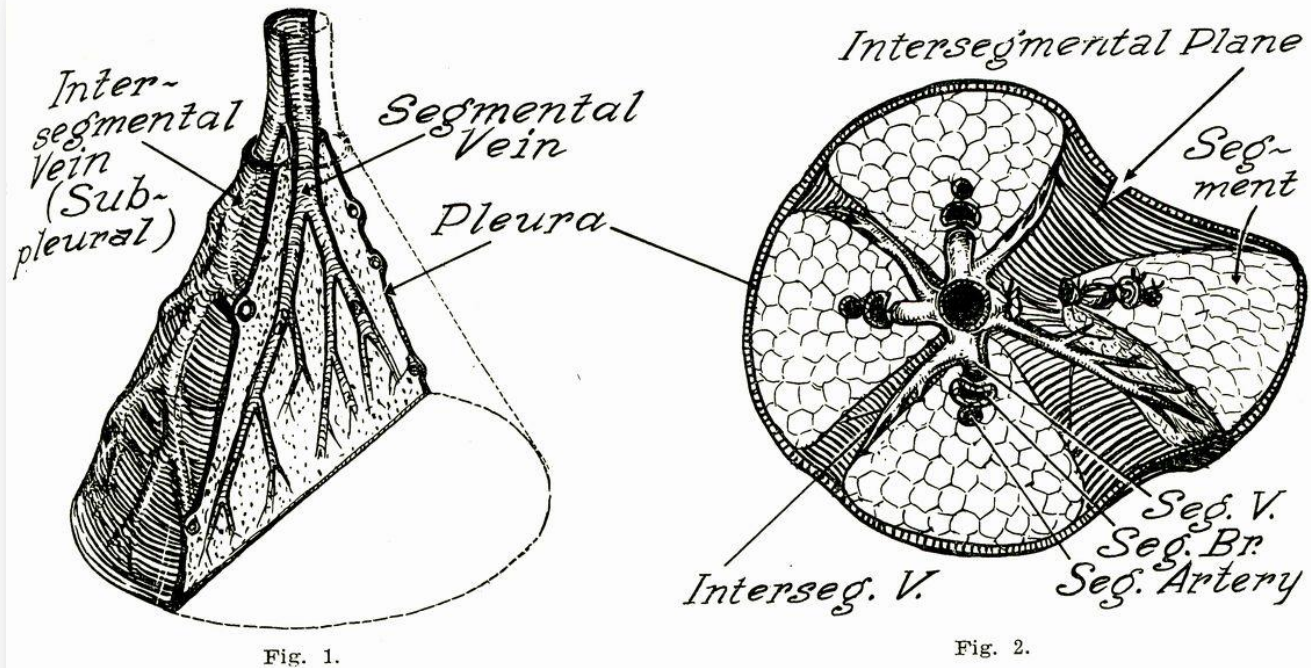
Let us calculate the volume of a segment.

If Segment is a cube,

$120-350 \text{ cm}^3 = \text{same volume as a cube with sides}$
 6 mc long.



“Intersegmental plane” ?



Ramsay BH. The anatomic guide to the intersegmental plane. *Surgery* 1948: 533-538

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