Technical Aspects of Sublobar Resection and Oncological Indications

Hisao Asamura (JP)
hasamura@keio.jp/thymoma1983@gmail.com

Thoracic Surgery
Keio University School of Medicine
Tokyo, Japan
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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

- **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)

Pneumonectomy

Lobectomy

Cahan W. “Radical lobectomy” (1962)

Limited resection

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


Results:
5YSR: 56%
Local recurrence rate: 10%
Randomized trial of Lobectomy versus Limited Resection for T1N0 Non-small Cell Lung Cancer


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.

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.
Study cohort:
Stage I lung cancer: LOB N=19,718, Wedge resection N=7297, SEG N=1226
Propensity score matched 987 patients each From total 13,606 pts., from National Cancer Data Base (2003-2011).

Results:
• Significantly worse OS for SEG (HR=1.45) and WR (HR=1.70), both p<0.001
• No difference in 30-day mortality
• Median OS: 100 (LOB), 74 (SEG), 68 (WR) months (p<0.001).
• Sublobar resection was significantly associated with increased likelihood of positive surgical margins, lower likelihood of having more than three LNs examined, and significantly lower rates of nodal upstaging.

Conclusions:
• Sublobar resection had significantly worse OS for compared with LOB.
• Sublobar resections were associated with inadequate Lobectomy and positive surgical margins.
State of the Art 2016: 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

Asamura’s Operative Thoracic Surgery
Anterior Segmentectomy of the Right Upper Lobe

Division on intersegmental plane

After segmental resection

Asamura’s Operative Thoracic Surgery
Ramsay BH. The anatomic guide to the intersegmental plane. Surgery 1948: 533-538
How to Deal with Intersegmental Veins?:
A Cautious Note on Lymphatics in the Lung

Asamura’s Operative Thoracic Surgery
Intersegmental tissue
Subpleural tissue
Worst Scenario after Segmentectomy (First surgery at another hospital)

S$^{1+2c}$
Pathology at Initial Surgery

Surgery:
Left upper division segmentectomy

Pathology:
Invasive adenocarcinoma, papillary predominant
pT1aN0M0 stage IA

No description of resectional margin

Micropapillary pattern
CT Findings 43 Months after Surgery

A new nodule on the staple line
Completion Pneumonectomy

Tumor included surgical staples in the center.
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.
# 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

<table>
<thead>
<tr>
<th>Study</th>
<th>Sublobar Resection</th>
<th>Lobar Resection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>5-year Survival (%)</td>
</tr>
<tr>
<td>Pro lobar resection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCSG [15]</td>
<td>122</td>
<td>44</td>
</tr>
<tr>
<td>Warren [22]</td>
<td>66</td>
<td>43</td>
</tr>
<tr>
<td>Miller [23]</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>Martini [24]</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>Pro sublobar resection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Errett [25]</td>
<td>100</td>
<td>69</td>
</tr>
<tr>
<td>Pastorino [26]</td>
<td>61</td>
<td>55</td>
</tr>
<tr>
<td>Read [27]</td>
<td>113</td>
<td>84</td>
</tr>
<tr>
<td>Landreneau [28]</td>
<td>102</td>
<td>62</td>
</tr>
<tr>
<td>Okada [17]</td>
<td>130</td>
<td>91</td>
</tr>
<tr>
<td>Kodama [29]</td>
<td>46</td>
<td>93</td>
</tr>
<tr>
<td>Koike [30]</td>
<td>74</td>
<td>89</td>
</tr>
</tbody>
</table>

* Statistically significant.

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

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Worst Scenario

More segmentectomies, more recurrences.
A JCOG Strategy for Small Lung Cancers

- **JCOG0102**
  - Radiological study to define noninvasive adenocarcinoma on TSCT
  - One-arm, WWW/Seg (phase II)
  - T=< 2cm

- **JCOG0804**
  - One-arm, WWW/Seg (phase II)
  - T=< 2cm

- **JCOG0802**
  - Lob vs. Seg (phase III)
  - T=< 2cm

- **JCOG1211**
  - One-arm, Seg (phase II)
  - 2<T=< 3cm
Evaluation of GGO Lesion

**Consolidation (C):**
Solid part only

**Tumor (T):**
GGO as a whole

**Consolidation/Tumor ratio (CTR) = C/T**

**JCOG0102**

A Prospective Radiological Study of Thin-Section Computed Tomography to Predict Pathological Noninvasiveness in Peripheral Clinical IA Lung Cancer (Japan Clinical Oncology Group 0201)

Kenji Suzuki, MD, Teruaki Koike, MD, Takashi Asakawa, BSc, Masahiko Kasamoto, MD, Hisao Asamura, MD, Kenji Nagai, MD, Hirohito Tada, MD, Tetsuya Mitsudomi, MD, Masahiro Tsuibo, MD, Taro Shibata, MSc, Haruhiko Fukuda, MD, and Haruhumi Kato, MD, On behalf of the Japan Lung Cancer Surgical Study Group (JCOG JCSSG)
Prognostic Determinants for Adenocarcinomas with/without GGO Components

- Tumor size
- Size of “solid part”
Radiological noninvasive cancer:

- T1a (<2.0 cm)
- CTR<0.25

Tumor size

0 cm
JCOG0804
PII Wide wedge resection

2.0 cm
JCOG1211
PII Segmentectomy

3.0 cm
Standard procedure Lobectomy

C/T ratio

0
0.25
0.5
1.0

JCOG0802
PIII Lobectomy vs Segmentectomy
A JCOG Strategy for Small Lung Cancers

Radiological study to define noninvasive adenocarcinoma on TSCT

JCOG0102

JCOG0804
T=≤ 2cm

JCOG0802
T=≤ 2cm

JCOG1211
2<T=≤ 3cm

One-arm, WWW/Seg (phase II)

One-arm, Seg (phase III)

Lob vs. Seg (phase III)

One-arm, Seg (phase II)
A JCOG Strategy for Small Lung Cancers

![Diagram showing tumor size and C/T ratio categories for JCOG0804, JCOG0802, JCOG1211, and standard procedure lobectomy.]

- **Tumor size**:
  - 0 cm: JCOG0804 PII Wide wedge resection
  - 2.0 cm: JCOG1211 PII Segmentectomy
  - 3.0 cm: Standard procedure Lobectomy

- **C/T ratio**:
  - 0
  - 0.25
  - 0.5
  - 1.0

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

Endpoints:
- Primary: OS
- Secondary: pulmonary function

Sample size: 1,100

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

Non-inferiority design

Randomize:
- Lobectomy
- Segmentectomy

Peripheral carcinoma, <=2 cm
Negative hilar node
CTR>=0.25 (0.50)

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

Relapse free survival

Event = Relapse or all death

Cases analyzed: 888
Event: 53
1 YRFS, 98.2%; 2 YRFS, 94.7%, 3 YRFS, 90.6%; 4 YRFS, 86.0%

Overall survival

Event = All death

Cases analyzed: 888
Event: 23
1 YSR, 99.6%; 2 YSR, 98.1%, 3 YSR, 96.3%; 4 YSR, 92.9%
Logics in Non-inferiority Design for LOB vs. SEG

<table>
<thead>
<tr>
<th>Prognosis</th>
<th>Pulmonary function</th>
<th>Selection (Conclusion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No difference</td>
<td>SEG better</td>
<td>SEG</td>
</tr>
<tr>
<td>No difference</td>
<td>No difference</td>
<td>LOB (Indeterminate)</td>
</tr>
<tr>
<td>SEG inferior</td>
<td>SEG better</td>
<td>LOB</td>
</tr>
<tr>
<td>SEG inferior</td>
<td>No difference</td>
<td>LOB</td>
</tr>
</tbody>
</table>

SEG wins only when both of two endpoints meet.
Patient accrual as of 2016

**JCOG0804**
- T<= 2cm
- One-arm, WWW/Seg (phase II)
- Over, full, N=333

**JCOG0802**
- T<= 2cm
- Lob vs. Seg (phase III)
- Over, full, N=1,106

**JCOG1211**
- 2<T<= 3cm
- One-arm, Seg (phase II)
- Over, full, N=396
Present-day Indication of Limited Resections for Lung Cancer

- Reasonable indication for **compromised patients** with limited pulmonary reserve
- Reasonable indication for **noninvasive carcinomas (GGO-AIS, MIA)**
- Otherwise, better to **stay on LOB** until JCOG/CALGB studies have conclusions for recommendation.
18th World Conference on Lung Cancer (WCLC)

Pacifico Yokohama, YOKOHAMA, JPN
October 15-18, 2017
Congress Co-Presidents: H. Asamura (J), KC Park (K)