Organ sparing surgery: Sublobar anatomical resection versus lobectomy?
Disclosure slide

**Lecture honorarias**

Boehringer Ingelheim

KarlStorz GmbH

KLS Martin
Key messages

1. **Oncologic segmentectomy** = central division of segmental artery, vein and bronchus, adequate margins + systematic lymph node sampling (> 10)

2. Rationale for segmentectomy: spares pulmonary function, has less complications and inferior postoperative mortality.

3. Technical issues are: safety margins, adequate lymph node removal and definition of intersegmental planes.

4. Oncologic efficacy of segmentectomy may be equal to lobectomy in elderly and in stage I tumors.

5. Randomized trials with caucasiens are awaited.
1. What is anatomical sublobar resection
2. Why sublobar resection
3. Sublobar resection and tumor size
4. Segmentectomy: technical aspects
5. Minimally invasive approach
6. Current evidence
1. **Definition of anatomical sublobar resection**

1. Separate division segmental artery, bronchus and vein

2. Bi- or trisegmentectomy is possible

3. Most frequent segmentectomies: S6, basilar segments, lingula, left upper division (80%)


1. What is sublobar resection
2. Why sublobar resection
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2. Rationale for surgery instead of SBRT

1. Clear histomorphology of tumor

2. Better staging for unsuspected more advanced disease
   - Definition of surgical margins (R)
   - Definition of nodal disease (N)
   - Definition of vessel (V) and/or lymphatic (L) invasion

3. Adequate tissue for pharmacogenomic testing (adjuvant therapy)

4. New techniques (anatomical segmentectomy) safe and oncological effective

### 3. Rationale for segmentectomy: function

<table>
<thead>
<tr>
<th>Author</th>
<th>Op</th>
<th>n =</th>
<th>Postoperative loss of function (12 months)</th>
<th>FEV1 loss</th>
<th>p =</th>
<th>DLCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keenan</td>
<td>Segment Lobe</td>
<td>48/133</td>
<td>5.1%</td>
<td>12.7%</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Takizawa</td>
<td>Segment Lobe</td>
<td>54/147</td>
<td>3.1%</td>
<td>8.4%</td>
<td>9.7</td>
<td>12.5</td>
</tr>
<tr>
<td>Macke</td>
<td>Segment Lobe</td>
<td>89/70</td>
<td>4.3%</td>
<td>8.2%</td>
<td>0.05</td>
<td>3.6</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>Seg 4.1%</td>
<td>Lobe 9.2%</td>
<td></td>
<td>Lobe 9.2%</td>
</tr>
</tbody>
</table>

**Segmental resection spares pulmonary function vs. lobectomy**

Ein Tochterunternehmen des Universitätsklinikum Essen
4. Rationale for segmentectomy: mortality

<table>
<thead>
<tr>
<th>Author</th>
<th>resection</th>
<th>N</th>
<th>30-day mortality</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Sherif</td>
<td>Sublobar</td>
<td>207</td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lobectomy</td>
<td>577</td>
<td>2.6%</td>
<td></td>
</tr>
<tr>
<td>Kilic</td>
<td>Segmentectomy</td>
<td>78</td>
<td>1.3%</td>
<td>11.5%</td>
</tr>
<tr>
<td></td>
<td>Lobectomy</td>
<td>106</td>
<td>4.7%</td>
<td>25.5% (p = 0.02)</td>
</tr>
<tr>
<td>Landreneau</td>
<td>Segmentectomy</td>
<td>312</td>
<td>1.2%</td>
<td>36.9%</td>
</tr>
<tr>
<td></td>
<td>Lobectomy</td>
<td>312</td>
<td>2.5%</td>
<td>32.7%</td>
</tr>
</tbody>
</table>
## 5. Rationale for segmentectomy: complications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of patients</strong></td>
<td>694</td>
<td>771</td>
</tr>
<tr>
<td><strong>Mode of resection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>11%</td>
<td>25%</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>83%</td>
<td>74%</td>
</tr>
<tr>
<td>Pneumonectomy</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>In-hospital deaths</strong></td>
<td>2%</td>
<td>0.5%</td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td>28%</td>
<td>12%</td>
</tr>
</tbody>
</table>

### Survival improvement period 1 - 2

| 5-years survival       | Stage IA 89% | p < 0.0001  |
|                        | Stage IB 75% | p = 0.047   |
|                        | Stage II    | p = 0.535   |
6. Rationale for segmentectomy: higher age

SEER database 1998-2007, patients aged ≥75 y, stage IA (T1a + b) NSCLC, n = 1640

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Risk adjusted CSS (T1a)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>HR 1.009</td>
<td>0.972</td>
</tr>
<tr>
<td>wedge resection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobectomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lobectomy</td>
<td>HR 0.98</td>
<td>0.908</td>
</tr>
</tbody>
</table>

1. What is sublobar resection
2. Why sublobar resection
3. Sublobar resection and tumor size
4. Segmentectomy: technical aspects
5. Minimally invasive approach
6. Current evidence
### 7. Mode of resection and tumor size

Retrospective analysis of 1272 NSCLC resections stage I

<table>
<thead>
<tr>
<th>Mode of Resection</th>
<th>≤ 20 mm T1a N =</th>
<th>5-y CSS</th>
<th>21-30 mm T1b N =</th>
<th>5-y CSS</th>
<th>&gt; 30 mm T2a N =</th>
<th>5-y CSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobectomy</td>
<td>106</td>
<td>92.4 %</td>
<td>174</td>
<td>87.4 %</td>
<td>216</td>
<td>81.3 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p = 0.91</td>
<td></td>
<td>p = 0.91</td>
<td></td>
<td>p = 0.05</td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>123</td>
<td>96.7 %</td>
<td>64</td>
<td>84.6 %</td>
<td>34</td>
<td>62.9 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>p = 0.91</td>
<td></td>
<td>p &lt;0.0001</td>
<td></td>
<td>p = 0.001</td>
</tr>
<tr>
<td>Wedge</td>
<td>35</td>
<td>85.7 %</td>
<td>14</td>
<td>39.4 %</td>
<td>6</td>
<td>0 %</td>
</tr>
</tbody>
</table>
## 8. Mode of resection and tumor size

<table>
<thead>
<tr>
<th></th>
<th>≤ 20 mm</th>
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<th></th>
<th>&gt; 30 mm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N =</td>
<td>5-y CSS</td>
<td>N =</td>
<td>5-y CSS</td>
<td>N =</td>
<td>5-y CSS</td>
</tr>
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1. What is sublobar resection
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9. Technical procedures: segmentectomy

1. Typical segmentectomy

2 parenchymal division planes:

S6, lingula, left upper division, basal segments (> 80%)

2. Atypical segmentectomy

3 parenchymal division planes, more technically complex:

right S7-8, or S9-10 bilaterally, S1-2 bilaterally, S3 bilaterally.

3. Extended segmentectomy

10. Technical procedures: issues

- Preparation of intersegmental planes
- Complete excision of the segmental pedicle
- N1 lymph node removal (VATS)
11. Technical procedures: margins

Safety margins:
tumor to intersegmental plane 2cm

Staple line extension into the neighboured segment = extended segmentectomy
12. Technical procedures: margins

NSCLC n = 428

Segment 182

IA = 109 0,2-3cm

IB = 73 3-7,0cm

12/109 11,0%

p = 0.004

32/182 17,6%

20/73 27,4%

Recurrence all

41/246 16,7%

24/27 (89%) of locoregional recurrences were seen when tumour margins were smaller than 2cm

Lobectomy 246
### 13. Technical procedures: lymphadenectomy

<table>
<thead>
<tr>
<th></th>
<th>Lobar resection</th>
<th>Sublobar resection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>577</td>
<td>207</td>
</tr>
<tr>
<td>Locoregional recurrence</td>
<td>8.0%</td>
<td>14%</td>
</tr>
<tr>
<td>Distant recurrence</td>
<td>20.0%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Patients in Stage IA</td>
<td>49.9%</td>
<td>77.8%</td>
</tr>
<tr>
<td>Number of LN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1</td>
<td>5.0%</td>
<td>55.5%</td>
</tr>
<tr>
<td>&gt;8</td>
<td>58.9%</td>
<td>19.9%</td>
</tr>
<tr>
<td>5-years OS</td>
<td>54%</td>
<td>40% (p = 0.004)</td>
</tr>
</tbody>
</table>

Limited or no lymph node sampling was a strong predictor for reduced survival.
Topics

1. What is sublobar resection
2. Why sublobar resection
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14. Case presentation: VATS lingulectomy

64 years old female, BMI 18

COPD III

Emphysema (FEV1 55%, RV 215%, DLCO 41%)

LOS 6 postop. Days

Histology: SCC pT1a (19mm), pN0 (0/16), L0, V0, R0, safety margins 16mm
15. VATS lingulectomy
1. What is sublobar resection
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## 16. Segmentectomy vs. Lobectomy

**Inclusion:** T1, N0 NSCLC, 6. edition TNM-classification

<table>
<thead>
<tr>
<th></th>
<th>After Lobectomy</th>
<th>After Limited Resection</th>
<th>OS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locoregional recurrence</td>
<td></td>
<td></td>
<td>65%</td>
<td>53% (ns)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distant recurrence</td>
<td></td>
<td></td>
<td>15</td>
<td>17 (ns)</td>
</tr>
</tbody>
</table>

| Segment (82), Wedge (40) | 8               | 21 (p=0.008) |

17. Advantage of segmentectomy: similar survival

18. Segmentectomy: oncologic efficacy

SEER-Database from 1998-2007, Adenocarcinoma, SCC, Stage IA

Lobectomy is superior over segmentectomy: OS, CSS

19. Segmentectomy: oncologic efficacy

<table>
<thead>
<tr>
<th>Superior CSS and OS of lobectomy vs. segmentectomy</th>
<th>All Tumors Stage I</th>
<th>Tumor size ≤ 20mm</th>
<th>Tumor size 21-30mm</th>
<th>Tumor size 31-70mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segmentectomy group:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N =</td>
<td>Size &lt; 2 cm</td>
<td>0 lymph nodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segmentectomy</td>
<td>581</td>
<td>50.1%</td>
<td>29.2%</td>
<td></td>
</tr>
<tr>
<td>Lobectomy</td>
<td>13.892</td>
<td>34.8%</td>
<td>5.0%</td>
<td></td>
</tr>
</tbody>
</table>

26 centers, D ≤ 2.0cm fit for lobectomy,

Segment = 63%
Wedge = 37%

OS = 94.0% 5y
DFS = 91.1% 5y

Recurrence rate 7.0%

Locoregional 24.6%
Lymph node 23.0%
Distant 37.7%

Limited resection is effective and superior to lobectomy
21. Segmentectomy: oncologic efficacy

**BUT:**
- Cohort = Japanese
- Age < 65y = 51.4%
- Women = 54.7%
- 0 comorbidity = 69.5%
- AdenoCA = 91.3%
- C/T < 0.25 = 46.6%
22. Current randomized trials: segment vs. lobe

1. Japanese Study: Segmentectomy vs Lobectomy for Stage I NSCLC
   Enrollment: 1100 patients   Study completion date: 2019

2. American study: Cancer and Leukemia Group B Comparison of Different Types of Surgery Stage IA NSCLC
   Enrollment: 1258 patients   Study completion date: 2021

3. European Study: Segment vs Lobectomy for T1a tumors
   Enrollment: 550 patients   Study completion date: 2022
Thank you for listening