Lung cancer Surgery

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Case 1

59 y, female, 40 py, incidental finding on chest X-ray
Questions

• What is your diagnosis?

• Further staging?

• Lobectomy or sublobar resection?

• Radiotherapy

• Adjuvant therapy indicated?
NSCLC - stages at presentation

- Stage I: 31%
- Stage II: 7%
- Stage III: 38%
- Stage IV: 24%
Stage-dependent survival for NSCLC

5-y survival after state-of-the-art treatment

- Stage I: 54-80%
- Stage II: 38-60%
- Stage IIIA: 10-30%
- Stage IIIB: <10%
- Stage IV: <5%

Tsuboi, World Conference IASLC 2009
Management of early and locally advanced lung cancer

Early:

Locally advanced:

Patient characteristics:

Infrastructure and Expertise:

<table>
<thead>
<tr>
<th>Early</th>
<th>Locally advanced</th>
<th>Patient characteristics</th>
<th>Infrastructure and Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_{1-2}, N_{0-1}</td>
<td>T_{3-4}, N_{2}, M_{0}</td>
<td>pulmonary / cardiac risk “age“</td>
<td>availability of treatment options</td>
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</table>
Stage I / II
Selection of patients for radical treatment?

• “Adequate" diagnostic and staging procedures are required for treatment recommendations

• Confirmation of NSCLC and stage by tissue

• Imaging is essential: CT (<4 weeks old), PET-CT, brain MRI (stage II)

• Endoscopic procedures for N₂/N₃: TBNA, EBUS / EUS confirm negative results by mediastinoscopy, if PET is not available
Selection of patients for radical treatment

Risk assessment of treatment especially surgery

- cardiovascular risk
  optimise by β-blockade, aspirin
- pulmonary risk
  spirometric values, DLCO, perfusion scans, emphysema morphology

→ decide within a multidisciplinary team including a thoracic surgeon (radio-oncologist) experienced in thoracic oncology
Management of early NSCLC (stage I and II)

- Surgery is the primary treatment for patients who tolerate resection
- Lobectomy including systematic lymph node dissection is adequate for most cases
- Minimal invasive approach by VATS is preferential (low perioperative mortality and morbidity)
- Pneumonectomy should be avoided whenever possible – consider bronchial / arterial sleeve resection
Stage I / II

- resection is treatment of choice

\[ \text{lobectomy pneumonectomy) } + \text{ lymphadenectomy} \]

- 5 - year survival
  - Stage I: 60-80%
  - Stage II: 40-50%
Management of early (stage I and II) NSCLC

- Lesser resection than lobectomy (segmentectomy) for stage I should be considered ➔ minimal difference in overall survival, higher local recurrence rate depends from tumor size and location LN involvement

- Patients not fit for surgery should be considered for stereotactic radiotherapy
Lobectomy vs Limited Resection for T1N0 NSCLC: A Lung Cancer Study Group

Time to Death (p=0.088)

Time to Recurrence (p=0.016)

Ann Thorac Surg 1995;60: 615-23

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Limited resection

Wedgeresection

Segmentectomy
Limited resection vs. lobectomy

Indication of Segmentectomy?

GGO: a CT Form of Early Peripheral Cancer

from H. Asamura, Tokyo
Segmentectomy: a sublobar resection

Asamura’s Operative Thoracic Surgery

from H. Asamura, Tokyo
Neo/Adjuvant Chemotherapy in early NSCLC

- In stage I/II preoperative chemotherapy is not recommended beyond a clinical trial.

- Adjuvant chemotherapy is recommended in stage II or III_{A1} for patients in good general condition (4 cycles cisplatin-based combination).
Minimally invasive (VATS) resections

2-4 incisions

30 – 70% of all lobectomies in experienced centers may preserve immunologic response and better compliance for adjuvant therapy

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Da Vinci Surgical System

2009 (2nd-generation robot):
Da Vinci Si Version
- improved 3D Endoscopic vision
- fluorescence imaging
- 1080p resolution
- multi-source screen system

2014:
Da Vinci Xi
- overhead instrument arm architecture
- smaller endoscope
- easier docking
- stapler (2016)
Patient Interest

- **Less Pain**

- **Faster Rehabilitation**

Demmy TL, Nwogu C; Ann Thorac Surg 2008
Technical Advantage RATS

Binocular Camera
3-D Visualization

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Dexterity: Endowrist
Fine Instrument Maneuverability in a confined narrow space
Technical Advantage RATS

Magnification
Downscaling + Tremor Filteration
Fine dissection of fragile intrathoracic structures

5 cm

1 cm
Technical Advantage RATS

Ergonomics:

counteractive movements

Courtesy of Th. Schmid
Comparison RATS - VATS
Lung saving (sleeve-) resections
The “range“ of Stage III

T4

N2

N3
N₂ disease is heterogeneous
Survival of patients with resected N2 NSCLC

(Andre, JCO 2000)
## N2 Subclassification

<table>
<thead>
<tr>
<th>Subset</th>
<th>Description</th>
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<tbody>
<tr>
<td>IIIA₁</td>
<td>Incidental nodal metastases found on final pathology examination of the resection specimen</td>
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<tr>
<td>IIIA₂</td>
<td>Nodal (single station) metastases recognized intraoperatively</td>
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<tr>
<td>IIIA₃</td>
<td>Nodal metastases (single or multiple station) recognized by prethoracotomy staging (mediastinoscopy, other nodal biopsy, or PET scan)</td>
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<tr>
<td>IIIA₄</td>
<td>Bulky or fixed multistation N₂ disease</td>
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Robinson, Ruckdeschel, Chest 2007
General considerations for Stage III

• Stage III is a very heterogeneous disease
• Only a fraction of the stage III patients are considered for combined multimodality including surgery
• Decide within a multidisciplinary team including a thoracic surgeon and radio-oncologist experienced in thoracic oncology
Stage IIIA (N\textsubscript{2}): Radiotherapy plus chemotherapy with or without surgical resection

Albain et al. Lancet 2009
Overall Survival of the Lobectomy Subset versus matched CT/RT subset

% Alive

0 25 50 75 100

Months from Randomization

0 12 24 36 48 60

CT/RT/S 57/90
CT/RT 74/90

logrank p = 0.002

Mortality:
Lobectomy 1 %
Pneumonectomy 26 %

Albain et al. Lancet 2009
## Mortality of pneumonectomy after induction therapy

<table>
<thead>
<tr>
<th>Author</th>
<th>n</th>
<th>Induction</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>d’Amato, 2009</td>
<td>68</td>
<td>x</td>
<td>21%</td>
</tr>
<tr>
<td>Stamatis, 2002</td>
<td>127</td>
<td>x</td>
<td>7%</td>
</tr>
<tr>
<td>Albain, 2005</td>
<td>24</td>
<td>x</td>
<td>27%</td>
</tr>
<tr>
<td>Sonett, 2004</td>
<td>40</td>
<td>x (&gt;59)</td>
<td>0%</td>
</tr>
<tr>
<td>Weder, 2009</td>
<td>176</td>
<td>x</td>
<td>3%</td>
</tr>
</tbody>
</table>
Stage IIIA/IIIB

Individualized treatment recommendation or general guidelines?

Consider:

- Heterogeneity of N$_2$-disease
- Heterogeneity of T-stage
- Heterogeneity of the patient
- Heterogeneity of institutional experience
$N_2$-disease is heterogeneous

single station

multiple stations
T-stage is variabel
The patient
Institutional differences

- Availability of specialized thoracic surgeons and/or radiotherapists
- Different surgical morbidity and mortality reported in different institutions
Management of advanced disease “operable“ (stage III ) NSCLC

- $T_3$, $N_{0-1}$ offer resection followed by adjuvant therapy
- $T_4$ disease consider radical multimodality treatment including surgery
- $N_2$ disease (non-fixed, non-bulky, single zone) consider surgery within multimodality treatment
- $N_2$ disease (bulky or fixed) consider radical radio- or chemoradio-therapy, role of surgery remains a matter of debate, only in studies
65 year old obese (BMI 25) female of RLL with metastases to lymph nodes # 10, 7, 4 R (tracheal infiltration)

Patient received 2 cycles of induction with CDDP/GEM. tolerated chemotherapy very poorly

Restaging with PET/CT  SD (± PD)

MRI of brain without metastasis
Patient is alive after 6 years with NED, assessed clinically and by CT
‘Resectable N2‘
which questions have to be answered?

• Is ‘N₂‘ technically resectable?
• Is surgery complete?
• Is surgery indicated from an oncological point of view?
• What is the risk for the patient?
• Does the patient tolerate pulmonary resection?

→ risk-benefit ratio
Final comment

- Treatment of NSCLC should be done “individualized“
- Different treatment modalities are in progress
- Treatment should be discussed in a multidisciplinary conference