Lung Cancer: From DNA to Surgery

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Lung Cancer

- Uncontrolled growth of malignant cells
  - One or both lungs
  - Tracheo-bronchial tree
- Result of repeated carcinogenic irritation
  - ↑ rates of cell replication
- Proliferation of abnormal cells leads
  - Hyperplasia
  - Dysplasia
  - Carcinoma in situ
Epidemiology of Lung Cancer

• According to 2009 statistics
  – 173,770 new cases
  – 160,440 deaths yearly
• Lung cancer deaths > Prostate + breast + colorectal cancers deaths
• ↓ incidence & deaths in men
• ↑ incidence & deaths in women
Women & Lung Cancer

- 80,660 new cases
  - 12% of all new cases
- 68,510 deaths
  - ↑ 150% between 1974 and 1994
- Women more prone to tobacco effects
  - 1.5x lung cancer than men with same smoking habits
Where Does it Come From?

- Radiation Exposure
- Smoking
- Environmental/Occupational Exposure
  - Asbestos
  - Radon
  - Passive smoke
Smoking Facts

- Tobacco use
  - Leading cause of lung cancer
- 87% of lung cancers related to smoking
- Risk related to
  - Age of smoking onset
  - Amount smoked
  - Gender
  - Product smoked
  - Depth of inhalation
Diagnosis

- History and Physical exam
- Diagnostic tests
  - Chest X-ray
  - Biopsy
    - Bronchoscopy
    - Needle biopsy
    - Surgery
- Staging tests
  - CT chest/abdomen
  - CT brain
  - PET scan
Symptoms

- Cough
- Dyspnea
- Haemoptysis
- Recurrent infections
- Chest pain
<table>
<thead>
<tr>
<th>Syndromes/Symptoms Secondary to Regional Metastases</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Esophageal compression</td>
</tr>
<tr>
<td>– Dysphagia</td>
</tr>
<tr>
<td>• Laryngeal nerve paralysis</td>
</tr>
<tr>
<td>– Hoarseness</td>
</tr>
<tr>
<td>• Symptomatic nerve paralysis</td>
</tr>
<tr>
<td>– Horner’s syndrome</td>
</tr>
<tr>
<td>• Cervical/thoracic nerve invasion</td>
</tr>
<tr>
<td>– Pancoast syndrome</td>
</tr>
<tr>
<td>• Lymphatic obstruction</td>
</tr>
<tr>
<td>– Pleural effusion</td>
</tr>
<tr>
<td>• Vascular obstruction</td>
</tr>
<tr>
<td>– SVC syndrome</td>
</tr>
<tr>
<td>• Pericardial/cardiac extension</td>
</tr>
<tr>
<td>– Effusion &amp; tamponade</td>
</tr>
</tbody>
</table>
Two Lung Cancer Cells, Classified

- **Non Small Cell Lung Cancer (NSCLC)**
  - Adenocarcinoma
  - Squamous Cell Carcinoma
  - Large Cell Carcinoma

- **Small Cell Lung Cancer (SCLC)**
  - Oat Cell
  - Intermediate
  - Combined
New T Definitions (T1)

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>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</td>
</tr>
<tr>
<td>T0</td>
<td>No evidence of primary tumor</td>
</tr>
<tr>
<td>Tis</td>
<td>Carcinoma in situ</td>
</tr>
<tr>
<td>T1</td>
<td>Tumor ≤3 cm 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)*</td>
</tr>
<tr>
<td>T1a</td>
<td>Tumor ≤2 cm in greatest dimension</td>
</tr>
<tr>
<td>T1b</td>
<td>Tumor &gt;2 cm but ≤3 cm in greatest dimension</td>
</tr>
</tbody>
</table>
# New T Definitions (T2 – T4)

<table>
<thead>
<tr>
<th>T2</th>
<th>Tumor &gt;3 cm but ≤ 7 cm or tumor with any of the following features (T2 tumors with these features are classified T2a if ≤ 5 cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Involves main bronchus, ≥ 2 cm distal to the carina</td>
</tr>
<tr>
<td></td>
<td>Invades visceral pleura</td>
</tr>
<tr>
<td></td>
<td>Associated with atelectasis or obstructive pneumonitis that extends to the hilar region but does not involve the entire lung</td>
</tr>
</tbody>
</table>

| T2a | Tumor >3 cm but ≤ 5 cm in greatest dimension |
| T2b | Tumor >5 cm but ≤ 7 cm in greatest dimension |

| T3 | Tumor >7 cm or one that directly invades any of the following: chest wall (including superior sulcus tumors), diaphragm, phrenic nerve, mediastinal pleura, parietal pericardium; or tumor in the main bronchus <2 cm distal to the carina" but without involvement of the carina; or associated atelectasis or obstructive pneumonitis of the entire lung or separate tumor nodule(s) in the same lobe |

| T4 | Tumor of any size that invades any of the following: mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, carina; separate tumor nodule(s) in a different ipsilateral lobe |

*Stade II*
## TNM

<table>
<thead>
<tr>
<th>Sixth Edition T/M Descriptor</th>
<th>Proposed T/M</th>
<th>N0</th>
<th>N1</th>
<th>N2</th>
<th>N3</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (≤2 cm)</td>
<td>T1a</td>
<td>IA</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T1 (&gt;2–3 cm)</td>
<td>T1b</td>
<td>IA</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T2 (≤5 cm)</td>
<td>T2a</td>
<td>IB</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T2 (&gt;5–7 cm)</td>
<td>T2b</td>
<td>IIA</td>
<td>IIIB</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T2 (&gt;7 cm)</td>
<td>T3</td>
<td>IIIB</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T3 invasion</td>
<td></td>
<td>IIB</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T4 (same lobe nodules)</td>
<td>T4</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIB</td>
<td>IIIIB</td>
</tr>
<tr>
<td>T4 (extension)</td>
<td>M1a</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>M1 (ipsilateral lung)</td>
<td>M1b</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>T4 (pleural effusion)</td>
<td></td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>M1 (contralateral lung)</td>
<td></td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>M1 (distant)</td>
<td></td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
</tbody>
</table>
Histo-pathological Factors

- Histological type
- Grade
- Lymphatic Invasion
- Blood vessel invasion
- Necrosis
- Cytokeratin expression
Table 2. Significant Prognostic Factors Revealed by Univariate Analyses in Surgically Resected Nonsmall Cell Lung Carcinoma Patients

<table>
<thead>
<tr>
<th>Poor prognostic factors</th>
<th>No.</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pN Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pN0</td>
<td>33</td>
<td>0.027</td>
</tr>
<tr>
<td>pN1</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>pN2</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>24</td>
<td>0.009</td>
</tr>
<tr>
<td>Perineural invasion (+)</td>
<td>10</td>
<td>0.02</td>
</tr>
<tr>
<td>Perineural invasion (-)</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Lymphatic invasion (+)</td>
<td>9</td>
<td>0.01</td>
</tr>
<tr>
<td>Lymphatic invasion (-)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Perineural invasion (+)</td>
<td>8</td>
<td>0.05</td>
</tr>
<tr>
<td>Perineural invasion (-)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Lymphatic invasion (+)</td>
<td>15</td>
<td>0.04</td>
</tr>
<tr>
<td>Lymphatic invasion (-)</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Perineural invasion (+)</td>
<td>6</td>
<td>0.25</td>
</tr>
<tr>
<td>Perineural invasion (-)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Lymphatic invasion (+)</td>
<td>13</td>
<td>0.31</td>
</tr>
<tr>
<td>Lymphatic invasion (-)</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Lymphatic invasion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>45</td>
<td>0.027</td>
</tr>
<tr>
<td>Positive</td>
<td>37</td>
<td></td>
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<tr>
<td>Perineural invasion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>58</td>
<td>0.0148</td>
</tr>
<tr>
<td>Positive</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
Molecular Staging

- Gene alterations in 50% of NSCLC
- Tumor response to anticancer therapies based on apoptosis induction
  - Active p53 as important modulator of DNA-damage-induced apoptosis
EGFR

Ligand binding and dimerization

Other receptor tyrosine kinases (e.g., IGF-1R, c-Met)

Gene transcription, cellular effects

Proliferation, Invasion, Metastasis, Resistance to apoptosis, Angiogenesis

Hypoxia

EGFR

LKB1
AMPK
TSC2

PI3K
Ras
Raf
Mek

mTOR
HIF-1α

mTOR

Gene transcription, cellular effects

Proliferation, Invasion, Metastasis, Resistance to apoptosis, Angiogenesis

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# Molecular Markers of Prognosis

<table>
<thead>
<tr>
<th>p53</th>
<th>Cyclin A</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGFR</td>
<td>PCNA</td>
</tr>
<tr>
<td>erbB2</td>
<td>16</td>
</tr>
<tr>
<td>ERCC1</td>
<td>RASS1A</td>
</tr>
<tr>
<td>RRM1</td>
<td>FHIT</td>
</tr>
<tr>
<td>PTEN</td>
<td>k-ras</td>
</tr>
<tr>
<td>ErbB-1</td>
<td>DNA methylation</td>
</tr>
</tbody>
</table>
Pathologically and Genotipically Tailored Surgical Therapy?

**TABLE 2.** Molecular Tests with Prognostic and Predictive Significance

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Prognosis</th>
<th>Prediction</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGFR mutation (exon 19 deletion v. exon 21 missense)</td>
<td>Better</td>
<td>Higher chance of responding to EGFR tyrosine kinase inhibitors</td>
<td>II</td>
</tr>
<tr>
<td>EGFR amplification</td>
<td>Better</td>
<td>Higher chance of responding to EGFR tyrosine kinase inhibitors</td>
<td>II</td>
</tr>
<tr>
<td>EGFR IHC positive</td>
<td>Worse</td>
<td>Higher chance of responding to EGFR tyrosine kinase inhibitors</td>
<td>II</td>
</tr>
<tr>
<td>KRAS mutation</td>
<td>Worse</td>
<td>No benefit from adjuvant cisplatin + vinorelbine, lower chance of responding to EGFR tyrosine kinase inhibitors</td>
<td>II</td>
</tr>
<tr>
<td>ERCC1 IHC positive</td>
<td>Better</td>
<td>No benefit from adjuvant cisplatin-based chemotherapy, less responsive to cisplatin</td>
<td>II</td>
</tr>
<tr>
<td>RRM1 IHC positive</td>
<td>Better</td>
<td>Less responsive to gemcitabine</td>
<td>II</td>
</tr>
<tr>
<td>p27 IHC positive</td>
<td>Better</td>
<td>No benefit from adjuvant cisplatin-based chemotherapy</td>
<td>II</td>
</tr>
<tr>
<td>ERCC1 and p27 “double-positive” by IHC</td>
<td>Better</td>
<td>No benefit from adjuvant cisplatin-based chemotherapy</td>
<td>II</td>
</tr>
<tr>
<td>ERCC1 and RRM1 “double-positive” by AQUA</td>
<td>Better</td>
<td>Less responsive to cisplatin and gemcitabine</td>
<td>II</td>
</tr>
<tr>
<td>MRP2 IHC positive</td>
<td>Worse</td>
<td>?</td>
<td>II</td>
</tr>
<tr>
<td>FasL-negative by IHC</td>
<td>?</td>
<td>More benefit from cisplatin-based adjuvant chemotherapy</td>
<td>II</td>
</tr>
<tr>
<td>High bTubIII by IHC</td>
<td>Worse</td>
<td>More benefit from adjuvant cisplatin + vinorelbine</td>
<td>II</td>
</tr>
<tr>
<td>“High-Risk” gene expression profile (various platforms)</td>
<td>Worse</td>
<td>?</td>
<td>II</td>
</tr>
</tbody>
</table>

*Level I evidence has been validated by data from a prospective, randomized trial. Level II evidence is based on retrospective cohort studies.*

EGFR, epidermal growth factor receptor; KRAS, Kirsten rat sarcoma viral oncogene homolog; ERCC1, excision repair cross-complementation group 1; RRM1, ribonucleotide reductase subunit 1; MRP2, multidrug resistance protein 2; FasL, ligand for tumor necrosis factor receptor superfamily member 6; bTubIII, class III beta-tubulin.
Staging for NSCLC

- CT
- PET
- EBUS vs. Mediastinoscopy
Stage III Lung Cancer
N2 Disease

- Mediastinal Nodes
  - 40% nodes >2 cm do NOT contain cancer
  - 40% of nodes with cancer <1 cm
Stage III Lung Cancer
N2 Disease

- CT scan $\rightarrow$ cT1 N0
  - 10% N2 disease
  - 5% found on PET

- CT scan $\rightarrow$ cT2 N0
  - 25% N2 disease
  - 15% found on PET
N2 Lung Cancer
PET Scan

- Downstage: 12%
- Upstage: 36%
- Change treatment: 67%
- False positive: 35%
- Nodes must be biopsied
### Mediastinal Nodes

<table>
<thead>
<tr>
<th></th>
<th>EBUS</th>
<th>CT</th>
<th>PET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
<td>92%</td>
<td>76%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td>100%</td>
<td>55%</td>
<td>70%</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>98%</td>
<td>61%</td>
<td>73%</td>
</tr>
</tbody>
</table>
Pre-operative Lymph Node Staging

• Direct surgical choices
  – Positive mediastinal lymph node not candidates for resection

• Staging necessary
  – Determining prognosis
  – Compare studies
Staging of Mediastinal Lymph Nodes

- **Non invasive**
  - CT
  - MRI
  - PET
  - Integrated PET-CT

- **Invasive**
  - Non surgical
    - TTNA – TBNA
    - EBUS – FNA
    - EUS – FNA
  - Surgical
    - Mediastinoscopy
    - VATS
    - Intra-operative
      - Sampling
      - Complete dissection
Mediastinoscopy should be done...

ESTS Guidelines

• All centrally located lung tumours
• All positive PET-scan lymph node
• Lymph node >16 mm on CT
  – 21% probability of N2 disease
• Omitted
  – Peripheral lesion with negative PET scan
Transbronchial and Transesophageal Needle Aspiration

- TBNA (EBUS-FNA)
  - U/S guided bronchoscopy with FNA
- EU/S - FNA
Mediastinoscopy
Mediastinoscopy

• Gold standard for invasively staging the mediastinum
  – Patients with known or suspected lung cancer

• Stations accessible by standard cervical mediastinoscopy
  – 2
  – 3
  – 4
  – 7
Mediastinoscopy

- Position
  - Supine position
- Preparation from chin to umbilicus, nipple to nipple
- Both arms are tucked to the side
- Extend the neck as far as possible
Mediastinoscopy

- Relationship of major vascular structures to the pretracheal space
Mediastinoscopy

- Orientation is provided by tracheal rings and tracheal bifurcation
- Lymph nodes dissected out using metal suction tip
Risks of Operation

- Operation Site
- Extent of operation
- Patients’ reserve
- Anesthesia
- Operator skill
Lung Function Test in Surgery Patients

• Indication
  – All Chest surgery patients
  – History of lung/airway disease
  – Heavy smoker
  – Exertional dyspnea

• Risks evaluation
  – Peri-operation
  – Subacute, long-term

• Avoid pulmonary complication
Preoperative Evaluation

• Identifying patients at risk
  – Evaluating risk
    • Finding modified factors to decrease risk
  – Detailed medical history, physical examination
  – Patient’s functional capacity
    • Degree of limitation of activity
    • Pulmonary function testing
      – Spirometry, lung volumes, diffusing capacity, oximetry, and arterial blood gases
  – Radionuclide lung scanning
  – Exercise testing
  – Invasive pulmonary hemodynamic measurements
• Risk stratification analysis
Spirometry

• Maximal voluntary ventilation <50% of predicted and FVC <70% of predicted
  – Associated with 40% risk for death
• FEV1
  – Most common PFT used for prediction
  – Accounts for variability in gender and size of patients for lung resection
  – Incidence of postoperative pulmonary complications
    • FEV1 <2 L 40%
    • FEV1 >2 L 19%
Spirometry for Lung Resection

• Pneumonectomy
  – FEV1 >2 L
  – MVV >55% of predicted

• Lobectomy
  – FEV1 >1 L
  – MVV >40% of predicted

• Segmentectomy or wedge resection
  – FEV1 >0.6L
  – MVV >40% of predicted
DLCO

- Independent predictor of postoperative outcome
- Reflects alveolar membrane integrity & pulmonary capillary blood flow in patient’s lungs
- DLCO ≥70% predicted much lower postpneumonectomy complication rate
- Low DLCO identifies patients with significant emphysema, and reduced pulmonary capillary vascular bed
  - Postoperative pulmonary hypertension
  - Arrhythmia
  - Cardiac dysfunction
Quantitative Lung Scan

- ppoFEV1 = preoperative FEV1 x % of radioactivity contributed by non-operated lung
- ppoFEV1 = preoperative FEV1 x (1-[S x 5.26] /100)
  - S: number of broncho-pulmonary segments involved
- Predicted postoperative FEV1 <1 L
  - Physiologic inoperability
- Predicted postoperative FEV1 <0.8 L
  - Surgical inoperability
  - COPD with CO2 retention
Pulmonary Exercise Test (PXT)

- Low ppoFEV1 <0.8 – 1 L or 35 – 40% of predicted values
  - Exercise testing
- Stresses entire cardiopulmonary & oxygen delivery systems
Oxygen Uptake

- VO2 related to
  - Age, sex, weight, and type of work performed
- VO2 max >20 mL/kg/min tolerate surgery
  - Acceptable morbidity and mortality
Stage I

- Includes IA and IB (tumors <3 cm and <5 cm)
  - No lymph nodes involved
  - Tumor >2 cm from carina
Surgical Management of Stage I NSCLC

- Best treated with surgery
- Lobectomy with mediastinal lymph nodes dissection
  - Preferred procedure
- If lymph nodes negative no further post-op treatment needed
- 5y survival 70% (60-80%)
Stage II NSCLC

- Stage II includes T1 & T2 with N1
  - Lobectomy or pneumonectomy with lymph nodes dissection
  - Sleeve lobectomy option for centrally located small tumors
- Overall 5y survival
  - 45% for IIA
  - 33% for IIB
Surgery for Stage IIIA NSCLC

- T1 – T4 with N2 (N1) involvement
- Lymph nodes MTS most important factor affecting treatment and prognosis
- cN2 bad results with surgery
  - Rush 11600 pts, 5y survival 16%
  - Mountain 540 pts, 5y survival 23%
- pN2 better results
  - Pearson 41%
Surgery for Stage IIIA NSCLC

• Biopsy of mediastinal lymph nodes always be done pre-operatively
• We operate pts with negative mediastinal lymph nodes
• Stage IIIB or IIIA N2 should have pre-op chemo-radiation and re-stage
• Overall 5y survival
  – 44% for T3 N0
  – 26% for T3 N1
Surgery or No Surgery for N2?

• Most thoracic oncologist and surgeons agreed that N2 disease in multiple levels should be treated with chemo-radiation (Ch/R).

• Most surgeon also believe that down staged or minimal stage N2 disease, if considered resectable after Ch/R, surgery is beneficial.
Role of Surgery after Neoadjuvant Treatment

• For responders
  – Surgical resection beneficial and increase survival

• Restaging to identify responders
  – EBUS-FNA, CT-PET, re-mediastinoscopy

• No surgery for N2 disease
  – 25% 5y survival for N0

• Morbidity & mortality increased
  – Right pneumonectomy
Surgery for T3 with Chest Wall Involvement

- If surgical candidates
  - complete resection is the aim
- Resection should be en-block
  - Clear margin of infiltrated chest wall
Operative Planning

• Anesthesia
  – Hilar dissection facilitated by unilateral lung ventilation
  – Double – lumen ET tubes and bronchial blockers isolate ipsilateral lung
  – Care must be taken with tube placement with centrally located tumors
    • Inadvertent trauma to endobronchial tumor lead to significant bleeding
Patient Positioning

- Lateral decubitus position, table flexed just cephalad to superior iliac crest
- If anterior thoracotomy or sternotomy planned,
  - Patient in supine position, with pillow placed in such a way as to elevate area of thorax that will be operated on
Patient Position – Posterior View
Patient Position – Postero-Lateral View
Incisions

• Postero-lateral incision
  – Standard for anatomic pulmonary resections

• Variety of smaller incisions
  – Posterior muscle sparing, anterior muscle sparing, axillary thoracotomies

• Thorax is entered at the 5th intercostal space
  – Affords excellent exposure to hilar structures
Right Pulmonary Hilar Anatomy

- Truncus anterior
- Right main bronchus
- Right pulmonary artery
- Right superior pulmonary vein
- Right inferior pulmonary vein
- Posterior ascending segmental artery
- Superior segmental artery
- Middle lobar pulmonary artery
- Basilar pulmonary artery

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Right Upper Lobectomy
Right Upper Lobectomy
Right Upper Lobectomy
Right Upper Lobectomy

- Right upper lobe
- Posterior ascending artery
- Interlobar pulmonary artery
Right Upper Lobectomy
Sleeve RUL Lobectomy
RUL with SVC Substitution
Reconstruction of Left PA
Reconstruction of Left PA
Pancoast Tumor
Reconstruction of Left PA
Chest Wall Cancer

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Chest Wall Cancer
Complications

- Bronchopleural fistula
- Empyema
- Hemorrhage
- Sputum retention
- Atrial fibrillation
- Persistent air leak
- Pain
Video Assisted Thoracoscopy

• Diagnostic
  – Operative staging
  – Wedge lung
  – Mediastinal biopsy
• Therapeutic
  – Major pulmonary resection
• Palliative
  – Sclerotherapy
  – Pericardial window
VATS Lung Resection

- Utility thoracotomy
- Manipulation with blunt forceps, open thoracotomy instruments
- Location of nodule (finger palpation)
- Dissection of fissures
- Vessels encircled with ties, then tied/stapled
- Bupivicaine to trocar sites
Surgical incisions
VATS Advantages

- Lower morbidity
- Reduced time for chest drainage
- Shorter hospital stay
- Patient acceptance (cosmetics)
Challenges in VATS

- Complications of endoscopic surgery
- Incomplete fissures
- Pain
- Mirror imaging
- Port site recurrence
Mobilize Anterior Trunk
Staple Anterior Trunk
VATS Lobectomy
Indications

• Usual cancer indications for lobectomy, plus
  – Clinical stage I cancer
  – Tumor <8 cm
• Benign disease (bullae, bronchiectasis, etc)
VATS Lobectomy

Contraindications

- Pancoast Tumors
- Extensive chest wall involvement
- EPP
- Vascular Sleeve
- Surgeon discomfort
VATS vs. Thoracotomy

- Fewer complications
- Less pain
- Better quality of life
- Better PFTs
- Less pneumonia
- Earlier recovery
- Easier for octogenarians
VATS vs. Thoracotomy

- Less lab charges
- Less anesthesia charges
- Less disposable equipment charges
- Less hospital charges
- Less complications
VATS vs. Thoracotomony
Recovery

- VATS
  - Earlier return to full activities
- VATS
  - Better short and long term QOL
VATS Lobectomy
Immunologic Impact

- Reduced stress response
- Reduced post-op C-reactive protein
- Reduced IL6, IL8, IL10 levels
- Enhanced cellular immune function
  - Better neutrophil and monocyte function
Conclusions

• VATS Lobectomy
  – True anatomic resection
  – Node dissection via minimally invasive surgery

• VATS Lobectomy
  – Safe procedure
  – Complete cancer operation
VATS vs. Thoracotomy

- VATS lobectomy should be standard of care for early stage lung cancer
Take Home Messages

• Surgery the best for stage I & II

• Accurate staging
  – Localized disease and Complete Resection requirements for cure

• Pre-op detected N2 disease poor surgical prognosis

• Re-evaluation after CT/RT for possible surgical excision is important option