Lung Cancer – Identifying the surgical candidate

Jason Ladwig, M.D.
No financial relations to disclose
When is surgery an option?

- Stage 1
- Stage 2
- Stage 3
  - If possible
  - May vary case to case
  - May be considered after chemo/radiation
<table>
<thead>
<tr>
<th>T/M</th>
<th>Subgroup</th>
<th>N0</th>
<th>N1</th>
<th>N2</th>
<th>N3</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>T1a</td>
<td>Ia</td>
<td>IIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T1</td>
<td>T1b</td>
<td>Ia</td>
<td>IIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T2</td>
<td>T2a</td>
<td>Ib</td>
<td>IIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T2</td>
<td>T2b</td>
<td>IIa</td>
<td>IIb</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T3</td>
<td>T3 (_{&gt;7})</td>
<td>IIb</td>
<td>IIIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T3</td>
<td>T3 (_{Inv})</td>
<td>IIb</td>
<td>IIIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T3</td>
<td>T3 (_{Satell})</td>
<td>IIb</td>
<td>IIIa</td>
<td>IIIa</td>
<td>IIIb</td>
</tr>
<tr>
<td>T4</td>
<td>T4 (_{Inv})</td>
<td>IIIa</td>
<td>IIIa</td>
<td>IIIb</td>
<td>IIIb</td>
</tr>
<tr>
<td>T4</td>
<td>T4 (_{Ipsi,Nod})</td>
<td>IIIa</td>
<td>IIIa</td>
<td>IIIb</td>
<td>IIIb</td>
</tr>
<tr>
<td>M1</td>
<td>M1a (_{Contra,Nod})</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>M1</td>
<td>M1a (_{Pl,Disem})</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
<tr>
<td>M1</td>
<td>M1b</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
</tbody>
</table>

Surgical Approaches

- Thoracotomy
- Video Assisted Thor
- Robotic VATS
Surgery

- Goal of surgery is to completely resect the tumor
- May involve a lobectomy, bi-lobectomy, or pneumonectomy
- In patients that may not tolerate lobectomy, wedge resection or segmentectomy is an option but is sub optimal
  - J Clin Oncol. 2014 Aug 10;32(23):2449-55 (no major difference)
  - J Surg Oncol. 2014 Oct 16 (meta analysis – seg. < lobe)
  - J Thorac Cardiovasc Surg. 2014 Nov 13 (lobectomy slightly better)
Determining Suitable Candidates

- General Health
  - Are they ambulatory
  - What other comorbidities do they have
  - Are their comorbidities likely to result in death before their cancer would

- Age - per the ACCP guidelines should not be a deciding factor of its own

  91 year old man, unable to walk more than 20 ft with a walker due to severe arthritis. Not considered a candidate for knee/hip replacement. He has dementia which is obvious during the visit and is cared for by his elderly wife. Found to have a 12mm nodule in the RLL, positive on PET scan.
Determining Suitable Candidates

* Cardiac Health
* Thoracic Revised Cardiac risk Index (Lee, TH et al Circulation 1999; 100:1043-1049)
Figure 1. [Sections 2.4, 3.0, 4.0] Physiologic evaluation cardiac algorithm. *ThRCRI.* *P*neumonectomy: 1.5 points; previous ischemic heart disease: 1.5 points; previous stroke or transient ischemic attack: 1.5 points; creatinine > 2 mg/dL: 1 point. ACC = American College of Cardiology; AHA = American Heart Association; CABG = coronary artery bypass graft surgery; CPET = cardiopulmonary exercise test; PCI = percutaneous coronary intervention. Modified and reproduced with permission of the European Respiratory Society. Eur Respir J. July 2000; 34:17-41. doi:10.1183/09031936.00184308

- ThRCRI = 2
- or any cardiac condition requiring medications,
- or a newly suspected cardiac condition,
- or inability to climb 2 flights of stairs

**Yes**

- Physical examination
  - Baseline ECG
  - History
  - Calculate ThRCRI

**No**

Cardiac consultation, with noninvasive cardiac testing and treatments as per AHA/ACC guidelines

Need for coronary intervention (CABG or PCI)

- Continue with ongoing cardiac care
- Institute any needed new medical interventions (i.e., beta-blockers, anticoagulants, statins)

- Postpone surgery for > 6 weeks and re-evaluate

Proceed to CPET and Pulmonary Function tests

Proceed to Pulmonary function tests

*ThRCRI (Thoracic revised Cardiac Risk Index). Ref 50
- Pneumonectomy: 1.5 points
- Previous ischemic heart disease: 1.5 points
- Previous stroke or TIA: 1.5 points
- Creatinine > 2 mg/dL: 1 point
Determining Suitable Candidates

* Physiologic testing of the lung
  * Spirometry
  * Diffusion Capacity
  * ABG
  * Stair climb
  * Shuttle walk
  * Cardiopulmonary exercise test
Present guidelines recommend preoperative Spirometry and measurement of the FEV1

AND calculation of the predicted post operative (PPO) FEV1

- Pneumonectomy: preop FEV1 x (1 - fraction of total perfusion of the resected lung)
- Lobectomy: preop FEV1 x (1 – (segments to be removed)/total segments (usually 19)
It is also recommended that Diffusing Capacity (DLCO) also be measured
AND the PPO DLCO be calculated

Using the same equations as for FEV1
- Pneumonectomy: preop DLCO x (1 - fraction of total perfusion of the resected lung)
- Lobectomy: preop DLCO x (1 – (segments to be removed)/total segments (usually 19)
Determining Suitable Candidates

PPOFEV1 and PPODLCO > 60% => proceed without further testing

PPOFEV1 or PPODLCO < 60% but > 30% => low tech exercise testing

PPOFEV1 or PPODLCO < 30% => cardiopulmonary exercise testing
Why stratify?

- PPOFEV1 > 60% had a 12% morbidity rate versus a PPOFEV1 < 30% which had a 43% morbidity rate. Berry et al Ann Thorac Surg 2010;89(4):1044-1051
- DLCO <60% 25% mortality and 40% morbidity Ferguson et al J Thorac Cardiovasc Surg 1988;96(6):894-900
- 10% risk in complications for every 5% drop in PPO lung function Alam et al Ann Thorac Surg 2007;84(4):1085-1091
Exercise Testing

- **Low tech**
  - **Stair climb**
    - Ability to climb 3 flights of stairs (~14m) suggests low risk. 6.5% of patients able to do so had major cardiopulmonary complications versus 50% climbing less than 12m. Brunelli et al Chest 2002;121(4):1106-1110
    - **ACCP guidelines** favor >22m to indicate low risk
      - >22m had a PPV of 86% to predict VO2 max of 15ml/kg/min
        Brunelli et al Respiration 2010;80(3):207-211
Exercise testing

- Low Tech
- Shuttle walk: walking between 2 points, 10 m apart; speed increases each min.; ending when to breathless to maintain speed
  - >400m correlates with Vo2 max > 15ml/kg/min

Win et al Thorax 2006;61(1):57-60
Exercise testing

* High Tech
  * Cardiopulmonary Stress/Exercise testing
    * Vo2 max > 20ml/kg/min or 75% predicted can proceed without further testing.
    * Vo2 max < 10 ml/kg/min or less than 35% predicted associated with high mortality

Diagnosis and Management of Lung Cancer, 3rd edition: ACCP Guidelines
Figure 2, Alessandro Brunelli et al CHEST 143 5 e166S-e190S
ACCP guidelines (3rd ed) recommendation 2.6.1:
“In patients with lung cancer who are potential candidates for curative surgical resection, it is recommended that they be assessed by a multidisciplinary team, which includes a thoracic surgeon specializing in lung cancer, medical oncologist, radiation oncologist, and pulmonologist.”
Thanks