Preoperative Assessment for Pulmonary Surgery

Peter Slinger MD, FRCPC
Preanesthetic Assessment for Thoracic Surgery (the context):

- Not gatekeepers
- Short vs. long term survival
- Disjoint assessment
55 y.o. Male, Carcinoma Right Middle and Lower lobes, Pneumonectomy
## Pulmonary Resection Morbidity and Mortality

<table>
<thead>
<tr>
<th></th>
<th>All Cases (LCSG ’89)</th>
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<tbody>
<tr>
<td>Mortality</td>
<td>4%</td>
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<td><strong>Respiratory</strong></td>
<td>21%</td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cardiac</strong></td>
<td>15%</td>
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LUNG SUBSEGMENTS

Total subsegments = 42

Example: right lower lobectomy

Postoperative FEV₁ decrease = 12/42 (29%)
Prediction of Postoperative Respiratory Failure in Patients Undergoing Lung Resection for Cancer

- 156 patients, lobect. 88, pneumonect. 26 respiratory complications 26%

- ppoFEV1 > 50%: no/minor complic's.
- ppoFEV1 < 40%: +/- major resp. complic's.
- ppoFEV1 < 30%: 10/10 postop. ventilation 6/10 died

FVC  FEV 1

1 sec.

Time
**Assessment of Operative Risk in Patients Undergoing Lung Resection**

mortal. = 1%, complics: resp. = 17%, cardiac = 11%

<table>
<thead>
<tr>
<th>Variable</th>
<th>p value (complic's.)</th>
</tr>
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<tr>
<td>Age &gt;60 yr.</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Pneumonectomy (64/331)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>ppoFEV1</td>
<td>&lt;.001 (independ.)</td>
</tr>
<tr>
<td>preop. FEV1 &lt;1l.</td>
<td>n.s.</td>
</tr>
<tr>
<td>elevated pCO2</td>
<td>n.s.</td>
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Diffusing Capacity Predicts Operative Mortality but not Long-term Survival
Increased Risk of Death:

- Homogeneous Emphysema
- FEV1 < 20%
- DCO < 20%
Resection of Lung Cancer Is Justified in High-risk Patients Selected by Exercise Oxygen Consumption

Mean preop. FEV1 = 41%, lobect./wedge/segment.

<table>
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<th>VO2 max</th>
<th>n</th>
<th>complic's.</th>
<th>mortal.</th>
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<tr>
<td>&gt; 20 ml/kg/min</td>
<td>10</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15-20 ml/kg/min</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>&lt;15 ml/kg/min</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
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Lance Armstrong

- VO2 max = 85ml/kg/min
- J Appl Physiol 98: 2191, 2005
The “3-Legged Stool” of Pre-Thoracotomy Respiratory Assessment:

Lung Mechanics
- FEV1 (ppo < 40%)
- MVV, FVC
- RV/TLC

Parenchymal Function
- DLCO (ppo < 40%)
- PaO2 < 65
- PaCO2 > 45

Cardio-Pulm. Reserve
- VO2 max (15 ml/kg/min)
- Stair climb >2 flt.
- 6 min. walk
- Exercise SpO2
Post-thoracotomy Anesthetic Management:

Predicted Postop. FEV1 (ppo FEV1%)

- **> 40%**
  - Extubate if patient “AWaC” (alert, warm and comfortable)

- **40-30%**
  - Extubate if other factors favorable:
    - Exercise Tol., DLCO, V/Q scan
    - Assoc. diseases

- **30-20%**
  - Consider Extub. if all favorable plus TEA

- **< 30%**
  - Other patients: staged wean of ventilation
Post-thoracotomy Cardiac Complications

Ischemia
Arrhythmia

Days Post-op.

# pats.
Cardiac Risk Assessment for Thoracotomy

(ACC/AHA Guidelines, Anesth Analg 2007, 104:15-26)

**Intermediate Clinical Predictors**
- Mild Stable Angina, Prev. MI
- Diabetes
- Compensated / prev. CHF

**Branches**

- **Poor Functional Capacity**
  - Non-Invasive Testing
  - High Risk
  - ? Angio

- **Adequate Functional Capacity**
  - OK
  - OR

**Case Specific Mgmt.**
## Pulmonary Resection Morbidity and Mortality

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<th>&gt;80 Years (Osaki ’94)</th>
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<td>3%</td>
</tr>
<tr>
<td>Respiratory Complications</td>
<td>21%</td>
<td>44%</td>
</tr>
<tr>
<td>Cardiac Complications</td>
<td>15%</td>
<td>44%</td>
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</table>
Stair Climbing Predicts Post-lobectomy Complications in the Elderly

n= 109, Age >70, mortal. 3%, morbid. 27%

- ppo FEV1 % p= 0.05
- Cardiac co-morbidity p= 0.02
- Stair climbing p= .002

Pre-thoracotomy Cardiac Risk Assessment

- **Elderly**
  - **Poor/Mod. Ex.Tol**
    - < 4 METS
      - Non-invasive Test.
      - High Risk
      - ? Angio.
  - **Excellent Ex.Tol**
    - >> 4 METS
      - OR
      - Low Risk
Which Drug is **NOT** Effective in Preventing Post-thoracotomy Atrial Fib.?

1. Amiodarone
2. Digoxin
3. Flecanide
4. Metoprolol
5. Verapamil
6. Diltiazem
Which Drug is NOT Effective in Preventing Post-thoracotomy Atrial Fib.?

1. Amiodarone
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# COPD patients in Ac. Resp. Failure

ABG's air vs. 100% Oxygen

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<tr>
<th></th>
<th>Air</th>
<th>100% O2 (15 min)</th>
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<tr>
<td>PaCO2 (mm Hg)</td>
<td>65 +/- 3</td>
<td>88 +/- 5</td>
</tr>
<tr>
<td>PaO2 (mm Hg)</td>
<td>38 +/- 2</td>
<td>225 +/- 23</td>
</tr>
<tr>
<td>Min Vent (l/min)</td>
<td>10.2 +/- 0.5</td>
<td>9.5 +/- 0.7</td>
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Milic-Emilie J, Aubier M. Anes Analg 1980
COPD Ventilation-Perfusion Matching

Air
COPD Ventilation-Perfusion Matching

Air

High FiO2
<table>
<thead>
<tr>
<th>pH</th>
<th>pCO2</th>
<th>pO2</th>
<th>HCO3</th>
</tr>
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<tbody>
<tr>
<td>6.5</td>
<td>500</td>
<td>84</td>
<td>30</td>
</tr>
<tr>
<td>6.9</td>
<td>300</td>
<td>400</td>
<td>29</td>
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Arterial Blood Gases
16 yr. male, grain aspiration
Intercurrent Respiratory Problems in COPD

- Bronchospasm
- Atelectasis
- Infection
- Pulmonary edema
- (nutrition/exercise tolerance)
Pre-anesthetic Considerations for Lung Cancer (the “4 Ms”)

- Mass Effects
- Metabolic Effects: Na+, Ca++, Eaton-Lambert
- Metastases
- Medications: Bleomycin, Adriamycin, Cis-Platinum
Helping Surgical Patients Quit Smoking


Surgical Benefits:
- Decrease ST changes intraop.: 2 days
- Decrease wound complic’s: ≥4wk.
- Decrease Resp. Complications:
  - Cardiac: ≥8 wk.
  - Thoracic: > 4 weeks

Abstinence @ 1yr:
- After ACB: 55%
- Angioplasty: 25%
- Angiography: 14%
Preoperative Phyisotherapy

- Proven decrease in pulmonary complications in COPD
- Particularly in patients with excessive secretions
- No proven superior modality

Warner DO, Anesthesiology 2000, 92: 1467
Reduction of Respiratory Complications in Lung Resection by Thoracic Epidural

* p < .05
vs. without TEA

Will this patient tolerate a pneumonectomy?
Will this patient tolerate a pneumonectomy?

- Age 55
- FEV1 50%
- DLCO 45%
- Exercise tol.
  3 flights
- V/Q R:L
  40: 60
- pH 7.44
- PaCO2 48
- PaO2 68
Will this patient tolerate a pulmonary resection?

**Surgical Options:**

- Sleeve Resection
- Bi-lobectomy
- Segment/Wedge Resection
- VATS
- Emphysema Surg.
- LVR/Bullectomy
Initial Pre-Anesthetic Assessment for Pulmonary Resection

- **All patients:** Exercise tolerance, ppoFEV1%, D/C smoking, Regional analg., ? Imaging
- **ppoFEV1 < 40 %:** DLCO, Exercise test, V/Q scan
- **Cancer patients:** the “4-Ms”, s. electrolytes
- **COPD:** ABG, chest physio., bronchodilators
Final Pre-Anesthetic Assessment for Pulmonary Resection

- Review Initial Assessment and Test Results

- Examine the Chest X-ray and CT scan

- Assess the Risk of Hypoxemia During One-Lung Ventilation
Final Pre-Anesthetic Assessment for Pulmonary Resection

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- Examine the Chest X-ray and CT scan
- Assess the Risk of Hypoxemia During One-Lung Ventilation
Which Patient more likely Desaturate during OLV?

55 y.o. F, Emphysema
FEV1= 28%

60 y.o. M, Lung Ca.
Non-smoker, FEV1= 98%

R Thoracotomy, Upper Lobx.

Left VATS LVR
Prediction of Desaturation During One-lung Ventilation

- Right vs. Left Thoracotomy
- Lung elastic recoil
- Low PaO2 during 2-lung ventilation
- V/Q ratio to surgical side

60 y.o. M, Lung Ca. Non-smoker, FEV1= 98%
Preoperative Assessment for Thoracic Surgery References:

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