PRE OPERATIVE EVALUATION
FOR PULMONARY SURGERY

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COMMON PROCEDURE

- Pneumonectomy
- Lobectomy
- Wedge Resection
- Segmentectomy
Mortality Rates

- Pneumonectomy: 6.8%
- Bi-lobectomy: 4.4%
- Lobectomy: 3.9%
- Lesser Resection: 1.4%

(Damhuis et al., Eur Respir J 1996; 9:7-10)
PREOPERATIVE EVALUATION FOR LUNG RESECTION
PREOPERATIVE EVALUATION

**PART I: FITNESS FOR SURGERY**
- Age
- Pulmonary function
- Cardiovascular fitness
- Weight loss, performance status and nutrition

**PART II: OPERABILITY**
- Diagnosis and staging
- Operability and adjuvant therapy
- Operations available
- Locally advanced disease
PART I: FITNESS FOR SURGERY

- Age
- Pulmonary function
- Cardiovascular fitness
- Weight loss, performance status and nutrition
PART I: FITNESS FOR SURGERY

- Age
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PART I: FITNESS FOR SURGERY

- **Age**
  - Advancing age → increase risk
  - Surgery for clinically stage I and II in patients over 70 years = younger patients
  - Age over 80 alone is not a contraindication to lobectomy or wedge resection
  - Pneumonectomy is associated with a higher mortality risk in the elderly
PART I: FITNESS FOR SURGERY

- Age
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PART I: FITNESS FOR SURGERY

Pulmonary function

- **Step I**: Preop lung function
  - Arterial Blood Gas
  - Spirometry Analysis
  - DLCO

- **Step II**: Postop lung function
  - PPO FEV1, PPO DLCO
  - Quantitative Ventilation-Perfusion Scan
  - Quantitative CT Scan

- **Step III**: Cardiopulmonary exercise test
  - Shuttle walk
  - Exercise Testing: Oxygen Uptake (VO₂ Max)
**STEP 1: PRE OP ASSESSMENT**

**ABG**
- PCO2 > 50 mm Hg - traditional contraindication to lung resection
- PO2 < 90%

**Spirometer**
- FEV1 > 0.6 L for segmentectomy
- FEV1 > 1.5 L for a lobectomy
- FEV1 > 2 L for a pneumonectomy

**DLCO**
- DLCO < 60% predicted associated with ↑ mortality
STEP 2 POST OP ASSESSMENT

- PPO FEV1 >40%, PPO DLCO >40% and SaO2 >90% on air: average risk

- PPO FEV1 <40%, PPO DLCO <40% : high risk.

PPO FEV₁ = PRE OP FEV₁ × \( \frac{(19-\text{SEG. TO BE REMOVE})}{19} \)

PPO FEV₁ = PRE OP FEV₁ × \( \frac{(19- A)-B}{19-A} \)
Quantitative Ventilation-Perfusion Scan
- Highly accurate
- Inhaled 133Xe or IV 99Tc

Normally: 19 Segments (10 R & 9 L)
- Right Lung (3/2/5): 55 % & Left Lung(3/2/4): 45%

\[ \text{PPO FEV1} = \text{PREOP FEV1} \times \% \text{of radioactivity contributed by nonoperated lung} \]
Using 133Xe Inhalation:
- PPO FEV1 of < 1 L.

Using 99Tc Macroaggregate of Albumin Perfusion:
- PPO FEV1 of < 0.8 L is indicative of surgical inoperability.
STEP 3 CARDIOPULMONARY EXERCISE TEST

Shuttle walk
• A best distance on two shuttle walk tests of <25 shuttles (250 m)
• desaturation during the test of more than 4% SaO2

Stair Climbing and Walking Tests
• climb three flights of stairs → lobectomy.
• five flights of stairs → Pneumonectomy.

VO₂peak (Maximal oxygen consumption)
• <15 ml/kg/min indicates that a patient is a high risk for surgery
PART I: FITNESS FOR SURGERY

- Age
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PART I: FITNESS FOR SURGERY

Cardiovascular fitness

- ECG
- Murmur → echo
- MI → Sx 6 wk
# Cardiac Risk Factor

<table>
<thead>
<tr>
<th>Category</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Unstable coronary syndromes:</td>
</tr>
<tr>
<td></td>
<td>- Recent myocardial infarction with evidence of important ischaemic risk</td>
</tr>
<tr>
<td></td>
<td>based on clinical symptoms or non-invasive study</td>
</tr>
<tr>
<td></td>
<td>- Unstable or severe angina (grades 3 or 4)*</td>
</tr>
<tr>
<td></td>
<td>- Decompensated congestive cardiac failure</td>
</tr>
<tr>
<td></td>
<td>Significant arrhythmias:</td>
</tr>
<tr>
<td></td>
<td>- High grade atrioventricular block</td>
</tr>
<tr>
<td></td>
<td>- Symptomatic ventricular arrhythmias in the presence of underlying heart</td>
</tr>
<tr>
<td></td>
<td>disease</td>
</tr>
<tr>
<td></td>
<td>- Supraventricular arrhythmias with uncontrolled ventricular rate</td>
</tr>
<tr>
<td></td>
<td>Severe valvular disease</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Mild angina pectoris (grades 1 or 2)*</td>
</tr>
<tr>
<td></td>
<td>Prior myocardial infarction based on history or pathological Q waves</td>
</tr>
<tr>
<td></td>
<td>Compensated or prior congestive cardiac failure</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Minor</td>
<td>Advanced age</td>
</tr>
<tr>
<td></td>
<td>Abnormal ECG findings (left ventricular hypertrophy, left bundle branch</td>
</tr>
<tr>
<td></td>
<td>block, ST-T abnormalities)</td>
</tr>
<tr>
<td></td>
<td>Rhythm other than sinus (for example, atrial fibrillation)</td>
</tr>
<tr>
<td></td>
<td>Low functional capacity (for example, unable to climb one flight of stairs)</td>
</tr>
<tr>
<td></td>
<td>History of stroke</td>
</tr>
<tr>
<td></td>
<td>Uncontrolled systemic hypertension</td>
</tr>
</tbody>
</table>
PART I: FITNESS FOR SURGERY

Cardiovascular fitness

**MAJOR RISK**
- Formal cardiologist assessment
- CABG prior lung resection

**INTERMEDIATE RISK**
- Functional good: no further Ix
- Poor function: ECG, exercise test, echo

**MINOR RISK**
- ≥ 1 cardiovascular risk
- Hx TIA, CVA
PART I: FITNESS FOR SURGERY

- Age
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- Cardiovascular fitness
- Weight loss, performance status and nutrition
# PERFORMANCE STATUS

<table>
<thead>
<tr>
<th>Karnofsky index</th>
<th>Score</th>
<th>ECOG-WHO scale</th>
<th>Score</th>
</tr>
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<tbody>
<tr>
<td>Normal, no complaints</td>
<td>100</td>
<td>Normal activity</td>
<td>0</td>
</tr>
<tr>
<td>Able to carry on normal activities</td>
<td>90</td>
<td>Symptoms, but ambulatory</td>
<td>1</td>
</tr>
<tr>
<td>Minor signs or symptoms of disease</td>
<td>80</td>
<td>Some time in bed, but less than 50% of normal daytime</td>
<td>2</td>
</tr>
<tr>
<td>Cares for self, unable to carry on normal activity or do active work</td>
<td>70</td>
<td>Needs to be in bed more than 50% of normal daytime</td>
<td>3</td>
</tr>
<tr>
<td>Requires occasional assistance but able to care for most needs</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requires considerable assistance and frequent medical care</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disabled; requires special care and assistance</td>
<td>40</td>
<td>Unable to get out of bed</td>
<td>4</td>
</tr>
<tr>
<td>Severely disabled; hospitalisation indicated, though death not imminent</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very sick; hospitalisation necessary; active supportive treatment necessary</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moribund</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead</td>
<td>0</td>
<td></td>
<td></td>
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PART II: OPERABILITY

- Diagnosis and staging
- Operability and adjuvant therapy
- Operations available
DIAGNOSIS AND STAGING

• H&P
• CXR
• CT chest (including upper abdomen and adrenals)
• CBC, platelets
• Chemistry profile
• Smoking cessation
• Pulmonary function test, bronchoscope
# CA LUNG STAGING

<table>
<thead>
<tr>
<th>Sixth Edition T/M Descriptor</th>
<th>7th Edition T/M</th>
<th>N0</th>
<th>N1</th>
<th>N2</th>
<th>N3</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 (less than or equal to 2 cm)</td>
<td>T1a</td>
<td>IA</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T1 (&gt;2–3 cm)</td>
<td>T1b</td>
<td>IA</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T2 (less than or equal to 5 cm)</td>
<td>T2a</td>
<td>IB</td>
<td>IIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T2 (&gt;5–7 cm)</td>
<td>T2b</td>
<td>IIA</td>
<td>IIB</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T2 (&gt; 7 cm)</td>
<td>T3</td>
<td>IIB</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T3 invasion</td>
<td>T4</td>
<td>IIB</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T4 (same lobe nodules)</td>
<td></td>
<td>IIB</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIB</td>
</tr>
<tr>
<td>T4 (extension)</td>
<td>T4</td>
<td>IIIA</td>
<td>IIIA</td>
<td>IIIB</td>
<td>IIIB</td>
</tr>
<tr>
<td>M1 (ipsilateral lung)</td>
<td>M1a</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>M1b</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
<td>IV</td>
</tr>
</tbody>
</table>
DIAGNOSIS AND STAGING

Stage IA (peripheral T1ab, N0)
- PFTs (if not previously done)
- Bronchoscopy (intraoperative preferred)
- Mediastinoscopy and/or EBUS/EUS (category 2B)
- PET/CT scan

Stage IB (peripheral T2a, N0)
Stage I (central T1ab–T2a, N0)
Stage II (T1ab–2ab, N1; T2b, N0)
Stage IIIB (T3, N0)
- PFTs (if not previously done)
- Bronchoscopy
- Mediastinoscopy and/or EBUS/EUS
- PET/CT scan
- Brain MRI (Stage II, Stage IB [category 2B])
DIAGNOSIS AND STAGING

Stage IIB (T3 invasion, N0)
Stage IIIA (T4 extension, N0-1; T3, N1)

- PFTs (if not previously done)
- Bronchoscopy
- Mediastinoscopy and/or EBUS/EUS
- Brain MRI
- MRI of spine + thoracic inlet for superior sulcus lesions abutting the spine or subclavian vessels
- PET/CT scan
RECOMMEND

- PFT, bronchoscope, CT scan: all
- Mediastinoscope: all except T₁ a,b peripheral lesion
- MRI brain: stage IIb (T₃ invasion, No)
Average Risk

Estimate %ppo FEV₁ and %ppo DLCO

- %ppo FEV₁ and %ppo DLCO > 40
- %ppo FEV₁ or %ppo DLCO < 40
- %ppo FEV₁ < 30 or %ppo DLCO < 1650

Perform CPET

- VO₂max > 15 ml/kg/min
- VO₂max 10-15 ml/kg/min
- VO₂max < 10 ml/kg/min

- Average Risk
- Increased Risk
- Increased Risk
Stepwise approach to preoperative pulmonary assessment

**Step 1**
- Urgent or Emergent thoracic surgery
  - **Yes**: Very Severe Lung Disease (Obstructive, Restrictive, Vascular, Inflammatory)
    - **Yes**: Surgery Futile
    - **No**: Proceed to surgery
  - **No**: Go to Step 2

**Step 2**
- Elective thoracic resectional surgery *
  - **Yes**: FEV1 > 80% pp or > 2L
    - **Yes**: Proceed to surgery
    - **No**: Go to Step 3
  - **No**: Pneumonectomy
    - **Yes**: Additional testing (V/Q, exercise, etc)
    - **No**: FEV1 > 1.5 L, DLCO > 40% pp
      - **Yes**: Proceed to surgery
      - **No**: Additional testing (V/Q, exercise, etc)

**Step 3**
- Elective non-thoracic, non-resectional surgery *
  - **Yes**: Risk factors for PPCs
    - **Yes**: Aggressive risk factor modification
      - **Yes**: Proceed to surgery
      - **No**: Proceed to surgery
    - **No**: Proceed to surgery

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**Risk factors for PPCs**
- Preoperative
  - COPD, Age, smoking
  - NYHA class II Pulmonary hypertension, OSA, low albumin
- Intraoperative
  - Site of surgery, General Anesthesia
  - Pancuronium use, Duration of surgery

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CONCLUSION

- **HX & PE**
  - **Part 1 : Fitness**
    - Age
    - PFT
      - Step 1 : Pre op assessment
      - Step 2 : Predict post op function
      - Step 3 : Cardiopulmonary exercise test
    - Cardiac status
    - Performance status
  - **Part 2 : Operability**
    - Diagnosis and staging
      - PFT, bronchoscope, CT scan
      - Mediastinoscope
      - MRI brain
      - Bone scan
Hey baby, what's your sign?

Cancer.